Ordinance No. 2012-____

AN ORDINANCE APPROVING THE CENTER OF EXCELLENCE FOR HAZARDOUS MATERIALS MANAGEMENT'S ("CEHMM'S") ECONOMIC DEVELOPMENT PROJECT APPLICATION AND ADOPTING THE RELATED PROJECT PARTICIPATION AGREEMENT.

WHEREAS, pursuant to the terms of the Local Economic Development Act, NMSA 1978, Sec. 5-10-1, et seq., the local government must review each project application and approve a economic development project by ordinance; and

WHEREAS, the City of Carlsbad's Economic Development Plan, Carlsbad City Code Sec. 38-66 through Sec. 38-79, requires each project participation agreement to be adopted as an ordinance and enacted at a public meeting;

BE IT ORDAINED BY THE GOVERNING BODY OF THE CITY OF CARLSBAD, EDDY COUNTY, NEW MEXICO, that:

1. The Center of Excellence for Hazardous Materials Management ("CEHMM") is a qualifying entity in that it is a New Mexico domestic nonprofit corporation engaged in the manufacturing, processing, or assembling of any agricultural or manufactured products.

2 CEHMM submitted its economic development project application, attached as Exhibit "A", and hereinafter referred to as the "Application".

3. The City of Carlsbad reviewed and evaluated the Application based upon the provisions of the City of Carlsbad's Economic Development Plan, the financial and management stability of CEHMM, the demonstrated commitment of CEHMM to the community, and a cost-benefit analysis of the proposed project.

4. The City found that the proposed project meets the requirements of the Local Economic Development Act and the City of Carlsbad's Economic Development Plan, and that it qualifies as an appropriate economic development project under the applicable state and local laws and regulations.

5. The Application is hereby approved by the City Council of the City of Carlsbad, New Mexico.

6. As required by law, CEHMM has submitted to the Mayor and the City Council for their consideration, the draft project participation agreement attached as Exhibit "B", and hereinafter referred to as the "Agreement".

7. The City found that the Agreement meets the requirements of the Local Economic Development Act and the City of Carlsbad's Economic Development Plan.

8. The Agreement is hereby adopted as an ordinance by the City Council of the City of Carlsbad, New Mexico.

INTRODUCED, PASSED, ADOPTED AND APPROVED this ____ day of _____, 2012.

CITY OF CARLSBAD:

_____
DALE JANWAY, MAYOR

ATTEST:

_____
CITY CLERK

EXHIBIT "A"

CEHMM
Center of Excellence for Hazardous Materials Management
505 North Main Street • Carlsbad, New Mexico 88220 • 575.885.3700 • FAX 575.885.6422 • www.cehmm.org

February 14, 2012

Mr. Jon Tully
City Administrator
City of Carlsbad
P. O. Box 1569
Carlsbad, NM 88221-1569

Dear Mr. Tully:

Please accept this application pursuant to the local economic development assistance (LEDA) from the Center of Excellence for Hazardous Materials Management (CEHMM). All requisite documents are attached.

Please don't hesitate to contact me if you need any more information.

Sincerely,

Douglas C. Lynn
Executive Director

DCL:GB:ss
Attachments

cc: John Waters, CDOD

cc w/o atts: John Heaton, BOD chairman
Tom Martin, attorney

CENTER OF EXCELLENCE FOR HAZARDOUS MATERIALS MANAGEMENT (CEHMM)
LOCAL ECONOMIC DEVELOPMENT APPLICATION
(REQUIREMENTS SEC. 38-72)
FEBRUARY 2012

1. Identification information

1.a. Complete name and address of qualifying entity:

Center of Excellence for Hazardous Materials Management Inc.
505 N. Main Street
Carlsbad, NM 88220

1.b. Incorporation papers and by-laws:

Attached

1.c. List of board of directors and executive directors, with addresses:

Attached

1.d. Resumes of all directors and officers:

Attached

2. Evidence of financial solvency

2.a. Financial Statements for past three years:

Attached (2009 and 2010 audited financials provided, 2011 income statement and balance sheet provided as audit has not been completed)

2.b. Federal tax numbers, New Mexico State Taxation and Revenue Number and city business license:

CEHMM Federal Employer Identification Number: 90-0171217
CEHMM New Mexico CRS Number: 03-021-396-00-7
CEHMM City of Carlsbad Business Registration: ID 5448

2.c. Projected income statement for at least three years:

Attached

3. Evidence of organization capacity

3.a. Brief history of the qualifying entity:

Attached

3.b. Organizational chart of the qualifying entity:

Attached

3.c. Business plans for the qualifying entity and project:

Attached

3.d. Evidence of ability to manage the project:

1. *List and description of previously completed projects:*

   Attached

2. *Resumes of key staff:*

   Attached

3.e. The qualifying entity shall disclose the following information:

1. *Has the qualifying entity or any of its officers ever been involved in a bankruptcy?*

   No

2. *Has the qualifying entity for any of its officers ever defaulted obligations on which payments are not current?*

   No

3. *Does the qualifying entity have any loans or other financial obligations on which payments are not current?*

   No

4. Funding sources for the proposed economic development project

4.a. Equity investment of qualifying entity:

None

4.b. *Specific assistance being requested of the city:*

The requested equipment, see attached

4.c. *Funding sources other than the city with letters of commitment of intent to fund*:

None

5. *A complete and specific description of the proposed economic development project*

5.a. *Business activities to be conducted*:

Research and development

5.b. *Management and staffing requirements*:

Six FTEs

5.c. *Property and equipment requirements*:

No additional property required and no additional equipment required except for what is being requested

5.d. *Markets:*

None

5.e. *Transportation requirements*:

None

5.f. *Utility requirements*:

No upgrades required

5.g. *Solid and liquid waste disposal requirements*:

None

5.h. *Infrastructure requirements*:

Just the items requested

5.i. Regulatory compliance requirements:

None

6. A complete and specific cost-benefit analysis. The cost-benefit analysis shall show that the city will recoup the value of its donation.

Attached

7. A complete and specific description of the proposed economic development project's substantive contributions to the city including, but not limited to such factors as in-kind services to the city, jobs, expanded tax base, property or other things or service of value for the expansion or improvements of the economy.

Attached

8. A complete and specific description of the employee job training and career development plan for the proposed economic project.

All employees are currently on staff so no training will be necessary.

9. Any other information necessary for the city to make a determination as whether or not the applicant is a qualifying entity.

N/A

10. Any other information required of the applicant by the city.

The Center of Excellence for Hazardous Materials Management will provide any additional information requested by the city in a timely manner.

CEHMM LEDA Application
Attachment 4.b.

Assistance Being Requested

The Center of Excellence for Hazardous Materials Management (CEHMM) formally requests conveyance of ownership of the attached list of infrastructure/equipment. The subject equipment/infrastructure is vital to the ongoing, cutting-edge research and development work conducted on the CEHMM algae project. Failure to attain the equipment would result in the culmination of the CEHMM algae project, thus eliminating six employment positions within the organization. This equipment/infrastructure provides the mechanisms necessary for the research and development to continue. Furthermore, the equipment is vital in CEHMM's intent to incentivize investor inquiry into the genesis of a new and scientifically challenging industry in Carlsbad. Equipment and complimentary infrastructure purchased under the auspices of the Energy Innovation Fund represent a valuable, appealing private investment opportunity for investors and fosters new economic development potential for the area within the new and exciting emerging industry of algal cultivation.

CEHMM LEDA Application
Attachment 7.

Proposed Economic Development Project

The Center of Excellence for Hazardous Materials Management (CEHMM) has been conducting ongoing algal research since 2006. In June of 2010 CEHMM was recognized as the only fully integrated facility in the U.S. Full vertical integration is translated as having the capability to grow, harvest and extract oil from the algae in one location. Integral to this integration is the infrastructure/equipment that was acquired through the Energy Innovation Fund grant from the State of New Mexico. CEHMM applied for and was awarded the grant. In accordance with anti-donation edicts, CEHMM was required to collaborate with a public entity who would serve as a conduit for the transfer and disbursal of grant funds. Inasmuch as the city performed as the formal procurement agent of the subject equipment and infrastructure, title was retained by them.

CEHMM requires the subject equipment and infrastructure to continue the research and development currently in progress. Without this equipment and infrastructure, CEHMM's efforts will be severely encumbered which would result in elimination of not less than six current employment positions.

CEHMM's demonstration of the economic viability of an algal facility has intrigued the national and international investment community into investigating Carlsbad for the development of a new commercial enterprise. CEHMM research has attracted more than 10 different investment groups from both domestic and international markets. Failure to secure custody of the subject equipment and infrastructure would significantly impede the progress made to date in regards to attracting significant economic investment dollars to Carlsbad.

Retaining the existing six jobs will safeguard $674,496 per year toward the local economy (see cost benefit analysis). Additionally, this will provide CEHMM more time to attract investment capital for ramp up to commercialization. As a 501(c)(3) not-for-profit organization, CEHMM would accommodate the transition to commercial by providing the transfer of technology required to initiate and operate a large-scale commercial facility. An algae facility of this dimension would generate as many as 50 new lucrative jobs for the area (see business plan). CEHMM's proposal would provide the mechanism for the city to quickly and effectively recoup the value of the equipment many times over (see cost benefit analysis) while contributing toward more progressive, diversified economic development for the area.

CEHMM LEDA Application
Attachment 6.

Cost Benefit Analysis

Per the auspices of this LEDA, the approval to transfer the subject capital equipment and affiliated infrastructure to CEHMM will save six local jobs. The total annual salary for the six positions is $674,496 which is expected to remain constant for the entire calendar year. DOD statistics indicate that for every dollar spent in Carlsbad, it will subsequently be spent an additional three to seven times. In the event that these monies pass through the local economy another three times, this equates to more than $2.2M in spending within Carlsbad, by retaining the current six jobs.

The equipment and infrastructure subject to this LEDA is used in entirety, in the CEHMM algae project. This project has received national and international recognition for benchmarks and other advances in this global emerging industry. The majority of the subject equipment has been on site for two years or longer. All of the equipment is beneficial to the CEHMM project, however, there are certain components that require continual upgrades to accommodate project progression. For example, the extraction equipment can no longer handle the capacity of algae that CEHMM produces for its research activities. Based on current industry fair market value assessments, the used equipment is currently worth $561,900.

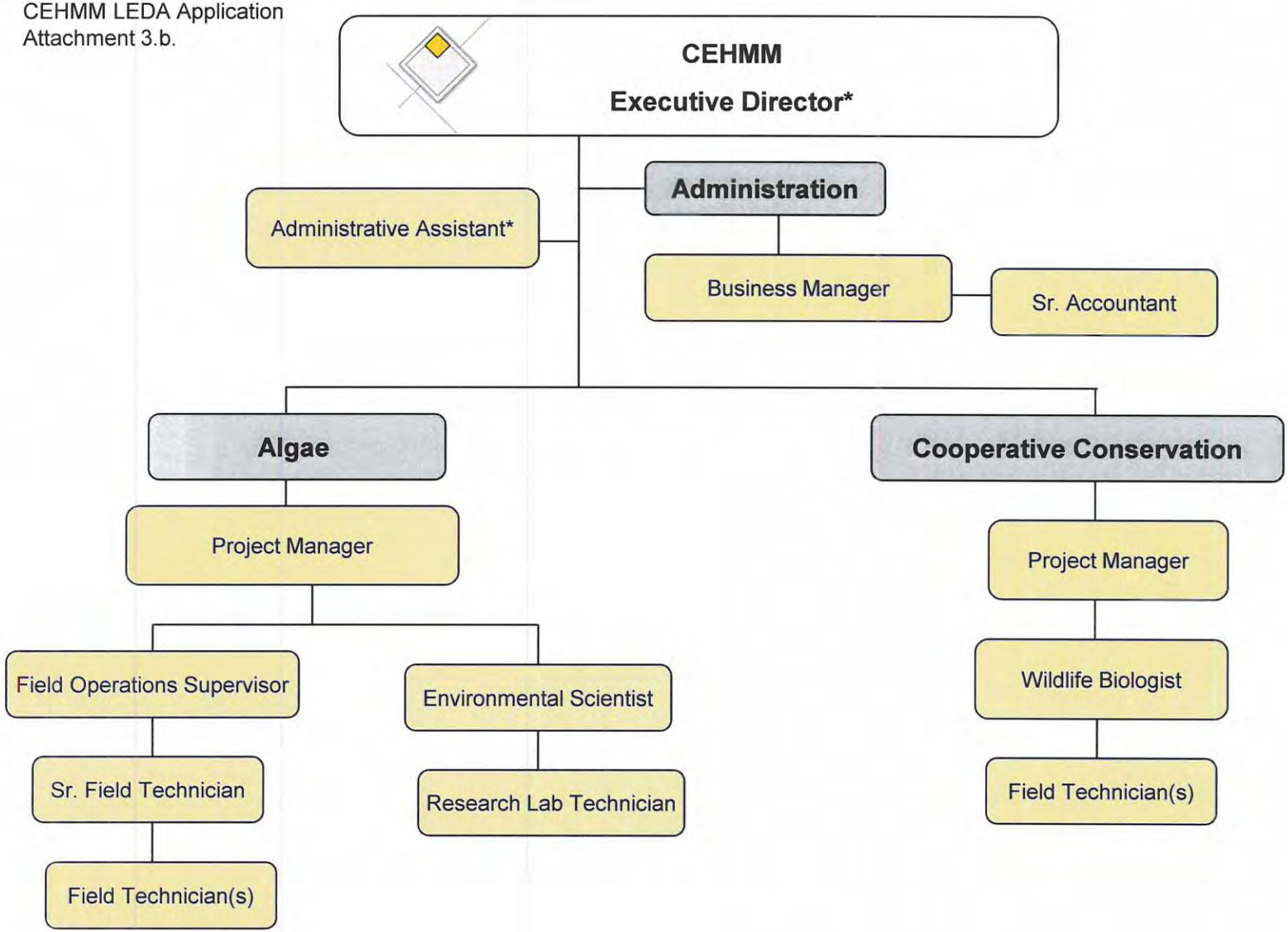
CEHMM is proposing a five year commitment. This five year commitment will return $3,800,000 (in salaries alone) to the city economy for the subject equipment valued at $561,900. Moreover, any new positions that may be created are expected to be filled locally.

Benefits to the city tax base are significant. In addition to $674K in job retention with commensurate salaries remaining in the local economy, CEHMM spends an additional $1.2M annually within the city for other operational and project costs. Currently two employees from other collaborative algal organizations travel to Carlsbad for one week each month, staying in local hotels and eating at local restaurants, in addition to other local expenses they incur during their stay.

CEHMM is actively seeking investment capital to start a commercial entity. If successful this could create up to 50 lucrative jobs for the area (see business plan).

CEHMM's research efforts into algae provided the mechanisms for the collaboration that culminated in the city's possession of the subject equipment and infrastructure. CEHMM's cutting edge, pioneering research and development in algal biomass cultivation and extraction proved commendable enough to warrant the organization as the successful recipient of the highly competitive Energy Innovation Fund grant through the State of New Mexico. The city of Carlsbad, as a public entity and valuable CEHMM partner, participated as the conduit or "pass-through" entity for the administration of the grant.

CEHMM LEDA Application
Attachment 3.b.



*Executive Director and Administrative Assistant under Algae Project

CEHMM LEDA Application
Attachment 6.

Cost Benefit Analysis

Per the auspices of this LEDA, the approval to transfer the subject capital equipment and affiliated infrastructure to CEHMM will save eight local jobs. The total annual salary for the eight positions is $760,415 which is expected to remain constant for the entire calendar year. DOD statistics indicate that for every dollar spent in Carlsbad, it will subsequently be spent an additional three to seven times. In the event that these monies pass through the local economy another three times, this equates to more than $2.2M in spending within Carlsbad, by retaining the current eight jobs.

The equipment and infrastructure subject to this LEDA is used in entirety, in the CEHMM algae project. This project has received national and international recognition for benchmarks and other advances in this global emerging industry. The majority of the subject equipment has been on site for two years or longer. All of the equipment is beneficial to the CEHMM project, however, there are certain components that require continual upgrades to accommodate project progression. For example, the extraction equipment can no longer handle the capacity of algae that CEHMM produces for its research activities. Based on current industry fair market value assessments, the used equipment is currently worth $561,900.

CEHMM is proposing a five year commitment. This five year commitment will return $3,800,000 (in salaries alone) to the city economy for the subject equipment valued at $561,900. Moreover, any new positions that may be created are expected to be filled locally.

Benefits to the city tax base are significant. In addition to $760K in job retention with commensurate salaries remaining in the local economy, CEHMM spends an additional $1.2M annually within the city for other operational and project costs. Currently two employees from other collaborative algal organizations travel to Carlsbad for one week each month, staying in local hotels and eating at local restaurants, in addition to other local expenses they incur during their stay.

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OFFICE OF THE
PUBLIC REGULATION COMMISSION

RESTATED CERTIFICATE OF INCORPORATION

OF

CENTER OF EXCELLENCE FOR HAZARDOUS MATERIALS MANAGEMENT

3302197

The Public Regulation Commission certifies that duplicate originals of Restated Articles of Incorporation attached hereto, duly signed and verified pursuant to the provisions of the

NONPROFIT CORPORATION ACT
(53-8-1 to 53-8-99 NMSA 1978)

have been received by it and are found to conform to law.

Accordingly, by virtue of the authority vested in it by law, the Public Regulation Commission issues this Restated Certificate of Incorporation and attaches hereto a duplicate original of the Restated Articles of Incorporation.

Dated: SEPTEMBER 20, 2005

In testimony whereof, the Public Regulation of the State of New Mexico has caused this certificate to be signed by its Chairman and the seal of said Commission to affixed at the City of Santa Fe.

Chairman

Bureau Chief

RESTATED ARTICLES OF INCORPORATION OF CENTER OF EXCELLENCE FOR HAZARDOUS MATERIALS MANAGEMENT

Pursuant to the provisions of the New Mexico Nonprofit Corporation Act (the "Act"), the undersigned corporation, the Center of Excellence for Hazardous Materials Management, adopts the following Restated Articles of Incorporation, which correctly set forth the articles of incorporation as amended, have been duly approved as required by law, and supersede the original articles of incorporation and all amendments thereto:

ARTICLE I: NAME

The name of the corporation is Center of Excellence for Hazardous Materials Management.

ARTICLE II: DURATION

The period of duration is perpetual.

ARTICLE III: PURPOSES

The corporation is organized exclusively for charitable, educational, and scientific purposes within the meaning of Section 501(c)(3) of the Internal Revenue Code and exists to promote excellence in hazardous materials management.

ARTICLE IV: RESTRICTIONS AND POWERS

Section 1 Restrictions

(a) No part of the net earnings of the corporation shall inure to the benefit of, or be distributable to, its directors or officers or other private persons, except that the corporation shall be authorized and empowered to pay reasonable compensation for services rendered and to make payments and distributions in furtherance of Section 501(c)(3) purposes.

(b) No substantial part of the activities of the corporation shall involve carrying on of propaganda or otherwise attempting to influence legislation, and the corporation shall not participate in or intervene in any political campaign on behalf of or in opposition to any candidate for public office. This prohibition extends to the distribution or publishing of political statements.

(c) Notwithstanding any other provisions of these articles, the corporation shall not carry on any other activities not permitted to be carried out by a corporation exempt from federal income tax under Section 501(c)(3) of the Internal Revenue Code or corresponding section of any future federal tax code.

Section 2 Powers. In furtherance of the foregoing purposes and subject to the above limitations, the corporation shall have all the powers conferred upon nonprofit corporations under the New Mexico Nonprofit Corporation Act (53-8-1 to 53-8-99 NMSA 1978) ("the Act") and shall have the power, either directly or indirectly, either alone or in conjunction or cooperation with others, to do or engage in any and all lawful acts and activities which may be necessary, useful, suitable, desirable, or proper for the furtherance, accomplishment, fostering, or attainment of any or all of the purposes for which the corporation is organized, and to aid or assist other organizations whose activities are such as to further accomplish, foster, or attain any of such purposes.

ARTICLE V: NO MEMBERSHIP

There shall be no members of the corporation. The affairs of the corporation shall be managed by its Board of Directors.

ARTICLE VI: COMPOSITION OF BOARD

The number of directors which shall constitute the whole board shall be fixed by the bylaws of the corporation. The bylaws shall also specify the corporation's internal rules regarding qualifications of directors and the time, place, and method or manner of their nomination, selection, appointment, or election; the rules for filling board vacancies; the rules for removal of directors from office; and, generally, the directors' duties and responsibilities.

ARTICLE VII: IMMUNITY AND INDEMNIFICATION OF DIRECTORS

Section 1 Liability. The directors, officers, and employees of the corporation shall not be personally liable for the corporation's obligations. The liabilities and immunities of the directors of the corporation shall be as provided for in NMSA 53-8-24 through 53-8-25.3.

Section 2 Liability of Directors. No director of the corporation shall be personally liable to the corporation for monetary damages for conduct as a director; provided, however, that this shall not eliminate the liability of a director for any act or omission for which such elimination of liability is not permitted under the Act.

Section 3 Indemnification. To the fullest extent permitted by the Act, the corporation shall indemnify against liability every director or officer of the corporation who is made a party to a proceeding by virtue of his or her serving or having served as a director or an officer of the corporation; provided, however, that no indemnification shall apply to a director's or officer's (1) breach of his or her duty of loyalty to the corporation, (2) acts or omissions not in good faith or involving intentional misconduct or a knowing violation of the law, or (3) any transaction from which the director or officer derived an improper personal benefit.

Section 4 Advancement of Expenses. The corporation may, but shall not be required to, pay for or reimburse the reasonable expenses incurred by a director or

officer who is a party to a proceeding in advance of the final disposition of the proceeding to the fullest extent permitted by the Act.

ARTICLE VIII: DISSOLUTION

Should the corporation be voluntarily dissolved, the Board of Directors shall, after paying or making provision for the payment of all the liabilities of the corporation, dispose of all the assets of the corporation by paying them over or transferring them to one or more nonprofit corporations engaged in activities substantially similar to those of the dissolving corporation and whose purpose or purposes are exclusively charitable, educational, or scientific within the meaning of Section 501(c)(3) of the Internal Revenue Code or, in the alternative, to the federal government or a local or state government for a public purpose, in such manner as the Board of Directors, by majority vote of the persons who are then directors of the corporation, may determine. The dissolution procedures shall be in compliance with NMSA 53-8-47 through 53-8-52 and in accordance with the laws or rules and regulations of any applicable agency of the United States Government.

Any corporate assets not so disposed of shall be disposed of by order of a court of competent jurisdiction of Eddy County, New Mexico, to one or more nonprofit corporations engaged in activities substantially similar to those of the dissolving corporation and whose purpose or purposes are exclusively charitable, educational, or scientific within the meaning of Section 501(c)(3) of the Internal Revenue Code or, in the alternative, to the federal government or a local or state government for a public purpose, as said court shall determine.

In no event may any member, former member, director, former director, officer, or former officer receive directly or indirectly any distribution of assets or portion of a distribution of assets upon the winding up of the affairs of the dissolving corporation.

DATED this 12th day of September, 2005.

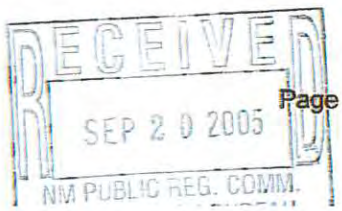
Center of Excellence for Hazardous Materials Management

By: William T Barthhh

Title: Executive Director

By: _____

Title: Treasurer



BYLAWS
OF
CENTER OF EXCELLENCE
FOR HAZARDOUS MATERIALS MANAGEMENT, INC.
Amended 10/2/07

ARTICLE I: PRINCIPAL OFFICE, REGISTERED OFFICE, AND AGENT

Section 1 The principal office for the transaction of the business of the corporation is hereby fixed and located in the City of Carlsbad, County of Eddy, State of New Mexico.

Section 2 The registered office and agent of the corporation required by the New Mexico Nonprofit Corporation Act to be maintained in the state of New Mexico shall be identical with the principal office in the state of New Mexico.

ARTICLE II: NAME

The name of the corporation shall be "Center of Excellence for Hazardous Materials Management, Inc.," also known as "CEHMM."

ARTICLE III: CORPORATE SEAL

The corporate seal shall be in the form of a circle and shall bear the name "Center of Excellence for Hazardous Materials Management, Inc.," with words or figures indicating the year and state in which the corporation was established.

ARTICLE IV: PURPOSE AND MISSION

Section 1 The corporation is organized exclusively for charitable, educational, and scientific purposes within the meaning of Section 501(c)(3) of the Internal Revenue Code.

Section 2 The mission of the Center of Excellence for Hazardous Materials Management is to promote excellence in national and international hazardous materials management. The Center supports initiatives in protection of human health and the environment while advancing economic development through applied technology.

ARTICLE V: BOARD OF DIRECTORS

Section 1 Members. There shall be no members of the corporation. The affairs of the corporation shall be managed by its board of directors. Any reference to "members" in these bylaws shall be understood to mean members of the board of directors.

Section 2 Number of Directors. The CEHMM Board of Directors shall consist of between five (5) and eleven (11) members. Included in this count is the corporation's executive director, who shall serve as an ex-officio voting member of the board.

Section 3 Qualifications of Directors. Directors shall be supportive of the purposes of the corporation and have an interest in and knowledge of hazardous materials management or other issues affecting the corporation. Directors shall be loyal to the mission of CEHMM and shall not act as representatives of their respective employers or of any other entity or organization.

Section 4 Selection of Directors. Directors shall be selected in accordance with these Bylaws and shall serve until their successor is chosen. The board of directors may form a Nominating Committee and charge it with producing a slate of candidates larger than the number of vacancies to be filled. The Nominating Committee may also make recommendations to the board.

Section 5 Terms. The term of a director shall be three (3) years and, subject to other provisions of these Bylaws, each director shall serve until his or her successor is selected and qualified.

(a) For purposes of constituting the initial board of directors, however, the membership of the initial board is divided into three groups, alphabetically, in accordance with the initial directors' last names. The first group of two directors will have a one-year term; the second group of three directors will have a two-year term; and the third group of three directors will have a three-year term. In this fashion, the terms of the directors will be staggered so that henceforth approximately one-third of the members of the board will be elected each year.

(b) It is stipulated that the CEHMM Board of Directors was established on October 1, 2003, for purposes of determining terms of office.

(c) Directors may be re-elected and may serve successive terms.

(d) Terms run from October 1 to September 30.

Section 6 Vacancies. When a vacancy occurs for any reason during the term of a director, the directors then in office may select a replacement to fill the remainder of the term, provided, however, that the board may, in its discretion, choose not to fill every seat, subject to the parameters of Article V, Section 2, of these Bylaws.

(a) Selection shall be by majority vote of the directors then serving.

(b) A director appointed to fill a vacancy will serve for the duration of the uncompleted term.

(c) If because of death, incapacity, or resignation there are fewer than five (5) members of the board, action by the directors to fill a vacancy in conformance with these Bylaws may be taken even though less than a quorum may be present.

Section 7 Removal. A director may be removed from office for good cause by a vote of two-thirds (2/3) of a majority of the directors then serving. After a director misses two consecutive meetings with an unexcused absence, a notice will be sent by

mail informing the director that he or she will be deemed to have resigned from the board of directors automatically and without further notice if the director misses a third meeting within the same calendar year.

Section 8 Compensation. Members of the board of directors shall receive no compensation, but they may be reimbursed for travel expenses for attendance at regular, special, and emergency meetings or at meetings of any committee of the corporation or on any other business of CEHMM, in such manner as the directors may from time to time establish as the travel policy of CEHMM. Also, CEHMM shall be bound by the provisions of Article III, Section 1(a) of the Articles of Incorporation as amended.

Section 9 Liability. Subject the provisions and limitations of the New Mexico Nonprofit Corporation Act, no director of this corporation now or hereafter selected shall be personally liable to any creditors or persons making claims against the corporation for any indebtedness or liability, and any and all creditors or claimants shall look only to the corporation's assets for payment.

Section 10 Indemnification. To the fullest extent permitted by the New Mexico Nonprofit Corporation Act, the corporation shall indemnify against liability every director or officer of the corporation who is made a party to a proceeding by virtue of his or her serving or having served as a director or an officer of the corporation; provided, however, that no indemnification shall apply to a director's or officer's (1) breach of his or her duty of loyalty to the corporation, (2) acts or omissions not in good faith or involving intentional misconduct or a knowing violation of the law, or (3) any transaction from which the director or officer derived an improper personal benefit.

(a) The corporation may bond employees or agents of the corporation as determined by the board of directors to be in the corporation's best interests.

ARTICLE VI: POWERS OF DIRECTORS

Section 1 General Powers. All corporate powers shall be exercised by and be under the authority of, and the business and affairs of the corporation shall be supervised by, the board of directors. Without limiting the full range of duties and powers of the board, the board shall have the power and responsibility to:

(a) Perform any and all duties required of board members collectively or individually by law, by the CEHMM Articles of Incorporation, and by these Bylaws;

(b) Make all major policy decisions and adopt rules and regulations for the corporation consistent with law and consistent with the corporation's founding documents now existing or later amended, as the directors may deem in the best interests of the corporation;

(c) Elect a chairman and other officers from among the directors;

(d) Meet at such times and places as required by these Bylaws or as determined by the board of directors;

(e) Approve minutes of preceding meetings;

(f) Appoint an executive director and determine the conditions of his or her employment;

(g) Approve projects to be supported by CEHMM, as well as their funding levels;

(h) Approve the annual budget;

(i) Authorize and accept an annual audit;

(j) Enter into contracts, working agreements, or statements of agreement with such agencies, corporations, organizations, and individuals as from time to time may be desirable or necessary to carry out the functions, plans, and purposes of the corporation;

(k) Apply for, receive, and utilize grants or other aid available from the state or federal government or from any other source, the receipt of funding from which and the scope of work for which are not inconsistent with the 501(c)(3) status of the corporation;

(l) Implement recommendations resulting from program evaluations or delegate this responsibility to the executive director as necessary or appropriate;

(m) Borrow money and incur indebtedness for the purposes of the corporation and cause to be executed and delivered in the corporate name promissory notes, bonds, debentures, deeds of trust, mortgages, pledges, hypothecations, or other evidences of debt and securities therefore; and

(n) Formulate guidelines and directives for the selection of successor members to the board of directors in accordance with these Bylaws and the Articles of Incorporation.

ARTICLE VII: OFFICERS

Section 1 Officers. The officers of the corporation will be a chairman, vice chairman, secretary, and treasurer, and any such officers as the board of directors may determine. The duties of the officers shall be as follows:

(a) Chairman – The chairman will
- (i) Perform all such duties as are incident to his or her office and such duties as may be required by law, the CEHMM Articles of Incorporation, the CEHMM Bylaws, or which may be prescribed from time to time by the board of directors;
- (ii) Chair all corporation meetings;
- (iii) When authorized, execute and deliver documents in the name of the corporation;
- (iv) Appoint committees and committee chairmen subject to approval of the board, except as otherwise expressly provided in the Articles of Incorporation or the Bylaws;
- (v) Serve as an ex-officio member of all standing committees.

(b) Vice Chairman – The vice chairman will
- (i) During the disability or absence of the chairman, chair all corporation meetings;
- (ii) Have such other powers and perform such other duties as may be prescribed by law, the CEHMM Articles of Incorporation, the Bylaws,

or as may be assigned to him or her from time to time by the board of directors;

(iii) Execute and deliver documents in the name of the corporation, as authorized by the board;

(iv) If the office of chairman is vacant, the vice chairman shall assume the office of chairman, and the board of directors shall appoint a new vice chairman.

(c) Secretary – The secretary shall

(i) Certify and keep at the principal office of the corporation the original of these Bylaws and any subsequent amendments; the original, conformed copy of the Articles of Incorporation and any subsequent amendments; the Exemption Letter from the Internal Revenue Service acknowledging the corporation's 501(c)(3) status; copies of annual reports required by the state of New Mexico; copies of tax returns; a book of minutes of meetings of the board of directors, including annual meetings, regular meetings, special meetings, and emergency meetings; a book of minutes of the meetings of corporate committees; and other key corporate documents.

(ii) Record or cause to be recorded all votes and minutes of all proceedings of the board of directors in a book to be kept for that purpose;

(iii) Give all notices of meetings required under these Bylaws;

(iv) Execute, attest, deliver, and seal documents of the corporation when authorized to do so by the board of directors.

The secretary may delegate to the corporation staff the responsibility of mailing notices of meetings and recording the minutes of the meetings.

(d) Treasurer – The treasurer shall

(i) Keep or cause to be kept a full and accurate account of the receipts and disbursements of the corporation;

(ii) Deposit or cause to be deposited all moneys and other assets in the name and to the credit of the corporation in such depositories as may be designated by the board of directors;

(iii) Disburse or cause to be disbursed corporate funds, making proper vouchers for all such disbursements;

(iv) From time to time examine the funds, securities, and property accounts of the corporation and make appropriate reports and accountings to the board of directors;

(v) Chair the Audit and Finance Committee.

Section 2 Interchangeability of Titles. For purposes of signing contracts and other documents, "chairman" and "vice chairman" may also be represented as "president" and "vice president" of the board, respectively, depending on the position title which a grantor or other entity prefers to recognize.

Section 3 Election. The board of directors shall elect all officers of the corporation from the board of directors for terms of one (1) year or until their successors are selected and qualified.

(a) Election of officers shall be held during the annual meeting.

(b) Officers may be elected to successive terms.

(c) No one person may hold more than one office.

(d) Officers shall have the powers and duties specified under these Bylaws and as are generally incident to the respective offices. Officers may also be assigned special duties by the board of directors.

Section 4 Vacancy or Removal. A vacancy in any office because of death, resignation, removal, disqualification, or otherwise shall be filled by the board of directors.

(a) An officer may be removed with or without cause by the majority vote of the board of directors.

(b) An officer may resign at any time by giving written notice to the board of directors or to the chairman of the board. Any such resignation shall take effect on the date of receipt or at any time specified therein and, unless otherwise specified therein, the acceptance of such resignation shall not be necessary to make it effective.

ARTICLE VIII: EXECUTIVE DIRECTOR

Section 1 Executive Director. The board of directors may select and appoint an executive director who will hold office and employment at the pleasure of the board, subject to any contract of employment. The executive director shall be an ex-officio member of the board, shall be entitled to attend all meetings of the board, and shall exercise the right to vote in all matters not pertaining to his or her own compensation.

Section 2 Duties. The executive director is the chief executive officer and principal spokesman for the corporation. The executive director shall have general supervision, direction, and control of the day-to-day business operations of the corporation, including setting budgets and hiring and firing employees and fixing their compensation. The executive director has overall responsibility for identifying CEHMM's projects as well as executing such projects after they are approved by the board. The executive director receives his or her direct instructions and guidance from the chairman of the board; however, the executive director may consult with other board members, as appropriate.

Section 3 Compensation. The executive director shall receive such compensation as determined by the board of directors.

ARTICLE IX: COMMITTEES AND ADVISORY GROUPS

Section 1 Committees. The board of directors may appoint standing or ad hoc committees as the board deems advisable. At least one member of the board must serve on each such committee, as may persons from inside or outside the corporation.

Committees shall exercise such powers, follow such procedures, and perform such duties as may be delegated to or prescribed for them by the board of directors. Each committee shall have a chairman appointed by the chairman of the board and shall keep regular minutes of its meetings and report the same to the board of directors.

(a) There shall be an Audit and Finance Committee, which shall be a standing committee.

Section 2 Advisory Groups. The board of directors may appoint one or more advisory groups as the board believes will be in the best interests of the work of the corporation.

ARTICLE X: MEETINGS

Section 1 Quorum. A quorum for the transaction of business at any meeting of the board shall be determined as follows: If the total number of directors is an even number, the presence of at least one-half (1/2) of that number of directors shall constitute a quorum. If the total number of directors is an odd number, the presence of at least a majority of the directors shall constitute a quorum.

(a) A quorum, once attained at a meeting, shall be deemed to continue until adjournment, notwithstanding the voluntary withdrawal of enough directors to leave less than a quorum.

(b) In the absence of a quorum at any meeting of the board of directors, the presiding officer may wait a reasonable time to see if a quorum will be formed. In no case shall business be transacted if a quorum is not present. If it appears a quorum will not be attained, a member of the board may move for a recess and, if this motion passes, measures may be taken to obtain a quorum. In the alternative, in the absence of a quorum, a member of the board may move that the board members present establish an *adjourned meeting,* which is another meeting that will be legally a continuation of the meeting at which the motion is adopted and, together with that meeting, will make up one session. If this motion passes, notice of the time and place of the adjourned meeting should be attempted to absent directors. If the requisite number of board members to form a quorum is present when the adjourned meeting commences, the meeting shall continue and business may be transacted. In no case shall a meeting be adjourned to the date of the next regular meeting of the board.

Section 2 Telephonic Participation. A member of the board of directors may participate in a meeting of the board by means of a conference telephone or similar communications equipment by means of which all persons participating in the meeting can hear each other at the same time. Participation by such means shall constitute presence in person at a meeting. Any person so appearing shall give notice of telephonic participation to the chairman of the board at least twenty-four (24) hours in advance.

Section 3 Meetings by Telephone. Whenever desired, the board of directors as a whole may conduct business by telephone conference call. If the board decides to conduct business by telephone conference call, notice of the meeting must be given to

all directors in accordance with the notice provisions stated in Section 9 of Article X of these Bylaws.

Section 4 Majority Vote. Unless otherwise specified in these bylaws, actions of the board of directors shall be by majority vote. Each director is entitled to one (1) vote.

Section 5 Proxy Voting. Proxy voting shall not be permitted for any matter coming before the board of directors.

Section 6 Written Consent. Any action required to be taken by the board of directors may be taken without a meeting if all members of the board consent in writing to such action. The written consents shall be filed with the minutes of the proceedings of the board. Action by written consent shall have the same force and effect as a unanimous vote of the directors.

Section 7 Place of Meetings. Meetings of the board of directors may be held at any place within or without the area to be served by the corporation, as decided by the board of directors. In the absence of any such place designation, meetings shall be held at the principal office of the corporation.

Section 8 Annual, Regular, Special, and Emergency Meetings. The board of directors shall meet not less than two (2) times during each calendar year. Other meetings may be held when requested by the chairman or when requested by at least one-third of the board members.

(a) Annual Meeting. The corporation shall hold an annual meeting once per calendar year, and it shall be held at a time and place to be determined by the board of directors. The annual meeting may coincide with one of the corporation's regular meetings. At the annual meeting, the board of directors will receive annual reports given by the officers, the standing committees, and the executive director; officers shall be elected; and the board may entertain any other proper business.

Written notice of the annual meeting shall be transmitted by E-mail, first-class mail, or special courier at least fourteen (14) days prior to the time of the holding of the meeting.

(b) Regular Meetings. The CEHMM Board of Directors shall schedule the times and places of its regular meetings for the calendar year by resolution, and this list shall be published to all the directors.

Written notice of regular meetings shall be transmitted by E-mail, first-class mail, or special courier at least ten (10) days prior to the time of the holding of the meeting, notwithstanding the giving of prior notice by board resolution.

(c) Special Meetings. A special meeting (also known as a *called meeting*) is a separate session of the corporation held at a time different from that of any regular meeting and is convened only to deal with important matters that arise between regular

meetings and that urgently require action by the board of directors before the next regular meeting. Notice for a special meeting shall specify the matters to be considered at the meeting, and action at that meeting shall be confined to the matters specified in the notice.

Written notice of the time, place, and exact purpose of a special meeting (the "call") shall be transmitted by E-mail, first-class mail, or special courier to all members of the board of directors at least seven (7) days prior to the time of the holding of the meeting.

(d) Emergency Meetings. Emergency meetings may be called by the chairman of the board or by one-third (1/3) of the members of the board on twenty-four hours notice.

Notice of emergency meetings shall be by telephone or other appropriate form of communication at least twenty-four (24) hours before the meeting.

Section 9 Waiver of Notice.

(a) The transactions of any meeting of the board of directors, however called and whenever held, shall be valid as though the meeting had been duly held after regular call and notice if

(i) a quorum be present, or

(ii) either before or after the meeting, a majority of the directors not present sign a written waiver of notice or a consent to the holding of such meeting or an approval of the minutes thereof.

All waivers, consents, or approvals under this article shall be filed with the corporation records or made a part of the minutes of the meeting.

(b) In addition to the foregoing, the actual attendance of a director at any meeting or portion of any meeting, either in person or by telephone, shall for all purposes constitute a waiver by that director of notice of such meeting.

Section 10 Rules of Order. The rules contained in the current edition of *Robert's Rules of Order Newly Revised* shall govern the corporation in all cases to which they are applicable and in which they are not inconsistent with these Bylaws and any special rules of order the corporation may adopt.

ARTICLE XI: FISCAL YEAR

The annual accounting period of the corporation shall be October 1 to September 30.

ARTICLE XII: SIGNING OF CHECKS AND CONTRACTS

Section 1 Checks. All checks, drafts, and other orders for payment of money shall be signed by the officer or officers of the corporation specified in Article VII of these Bylaws or by other such person or persons the board of directors may from time to time designate.

Section 2 Contracts. All contracts, notes, evidences of indebtedness, and leases of space for the corporation shall be signed by the officer or officers of the corporation specified in Article VII of these bylaws or by such other person or persons as the board of directors may from time to time designate.

ARTICLE XIII: AMENDMENTS

Section 1 Amendment of Articles of Incorporation. The board of directors may amend the Articles of Incorporation from time to time in any and as many respects as may be desired, so long as the Articles of Incorporation, as amended, contain only such provisions as are lawful under the New Mexico Nonprofit Corporation Act and as are consistent with the corporation's 501(c)(3) status.

(a) The written text of any proposed change of the Articles of Incorporation shall be furnished to the members of the board of directors at least ten (10) days prior to the meeting at which the proposed change will be considered and voted upon.

(b) To pass, a proposed amendment to the Articles of Incorporation must receive an affirmative vote of at least two-thirds (2/3) of the directors then serving.

(c) The secretary of the board of directors shall cause the amendment(s) of the Articles of Incorporation to be filed with the Public Regulation Commission, in accordance with the requirements of the New Mexico Nonprofit Corporation Act.

Section 2 Amendment of Bylaws. The corporation may amend its Bylaws at any meeting of the board of directors by an affirmative vote of two-thirds (2/3) of the directors present at the meeting.

Amended by the Board of Directors on October 2, 2007:

John A. Heaton, Chairman — Date: 10/2/2007

Michael H. Reynolds, Secretary — Date: 2 OCT 07

CEHMM LEDA Application
Attachment 7.

Proposed Economic Development Project

The Center of Excellence for Hazardous Materials Management (CEHMM) has been conducting ongoing algal research since 2006. In June of 2010 CEHMM was recognized as the only fully integrated facility in the U.S. Full vertical integration is translated as having the capability to grow, harvest and extract oil from the algae in one location. Integral to this integration is the infrastructure/equipment that was acquired through the Energy Innovation Fund grant from the State of New Mexico. CEHMM applied for and was awarded the grant. In accordance with anti-donation edicts, CEHMM was required to collaborate with a public entity who would serve as a conduit for the transfer and disbursal of grant funds. Inasmuch as the city performed as the formal procurement agent of the subject equipment and infrastructure, title was retained by them.

CEHMM requires the subject equipment and infrastructure to continue the research and development currently in progress. Without this equipment and infrastructure, CEHMM's efforts will be severely encumbered which would result in elimination of not less than eight current employment positions.

CEHMM's demonstration of the economic viability of an algal facility has intrigued the national and international investment community into investigating Carlsbad for the development of a new commercial enterprise. CEHMM research has attracted more than 10 different investment groups from both domestic and international markets. Failure to secure custody of the subject equipment and infrastructure would significantly impede the progress made to date in regards to attracting significant economic investment dollars to Carlsbad.

Retaining the existing eight jobs will safeguard $760,415 per year toward the local economy (see cost benefit analysis). Additionally, this will provide CEHMM more time to attract investment capital for ramp up to commercialization. As a 501(c)(3) not-for-profit organization, CEHMM would accommodate the transition to commercial by providing the transfer of technology required to initiate and operate a large-scale commercial facility. An algae facility of this dimension would generate as many as 50 new lucrative jobs for the area (see business plan). CEHMM's proposal would provide the mechanism for the city to quickly and effectively recoup the value of the equipment many times over (see cost benefit analysis) while contributing toward more progressive, diversified economic development for the area.

CEHMM LEDA Application - Attachment 4b

Materials and Equipment

Project Name: Energy Innvovation - CEHMM Biodiesel Project City Account Num.: 62-621-85011

Grant No.: 09-521-A083068-003

Date	Purchase Order No.	Name of Vendor	Description	Check No.	Invoice Amount	Balance	Current Value
					BUDGET AMOUNT	$ 1,123,000.00	
10/21/09	116330	Ditch Witch	Trencher Model	24308	$ 16,250.00	$ 1,106,750.00	$ 12,000.00
9/10/09	115433	SRS Corp.	Solvent recovery module (1) Distillation system (2) Tanks (2) Vessells (3) Pumps (3) Integral heat exchangers, (1) separator with integral solvent recovery (4) tanks (2) Pumps [379,886.25 less 14,453.13 GRT reimburse]	24327	$ 365,433.12	$ 741,316.88	$ 170,000.00
9/10/09	115433	SRS Corp.	Spent Biomass module, Extraction module(2 reactors, pump,extractor,condenser, column for solvent recovery, Makedown module 2 tanks and 1 pump Utilities Skid Air Compressor, hot water boiler water chiller	24318	$ 290,816.88	$ 450,500.00	$ 140,000.00
10/20/09	116307	Mueller Inc.	Pre-Engineering Metal Building Kit & Accessories	24428	$ 5,778.75	$ 444,721.25	$ 4,000.00
10/20/09	116306	VWR International	Premier blower/fixtures,spilltopper/no cut outs	24495	$ 9,875.13	$ 434,846.12	$ 6,000.00
10/20/09	116306	VWR International	Acid storage cabinet, Solvent storage cabinet, Vent kit F/Acid Storage Cabinet, Cabinet solvent Vent kit	24495	$ 2,876.26	$ 431,969.86	$ 2,000.00
10/14/09	116170	William Scotsman	Portable Lab Trailer 44x10	24596	$ 14,642.00	$ 417,327.86	$ 10,000.00
3/4/10	119572	KeeVac Industries Inc.	Pond Vacuum System	24907	$ 11,771.00	$ 405,556.86	$ 6,000.00
3/4/10	119071	Petrolab	Closed cup flashpoint tester	24880	$ 15,100.00	$ 390,456.86	$ 9,000.00
3/4/10	119561	Agilent Technologies	Mass Spectrometer	24720	$ 142,617.54	$ 247,839.32	$ 100,000.00
2/26/10	119560	Turner Designs	Trilogy Flourometer	24717	$ 15,682.82	$ 232,156.50	$ 10,000.00
2/26/10	119063	Zeltex Inc.	Portable Octane Analyzer	24719	$ 10,950.00	$ 221,206.50	$ 7,000.00
	119569	Aquatic Habitats Inc	Pond Monitoring System	24721	$ 3,511.61	$ 217,694.89	$ 1,500.00
	119568	DynaMax	Weather station	24892	$ 12,575.00	$ 205,119.89	$ 8,000.00
	120805	Truck Center-Ft Worth	500-510 barrell Frac tank	24961	$ 32,750.00	$ 172,369.89	$ 25,000.00
	120804	Western Depot	portable (dump) trailer	24971	$ 6,670.00	$ 165,699.89	$ 4,500.00
8/31/11	130677	Northern Tool	3-3" Suction/Discharge Kits	25942	$ 527.54	$ 165,172.35	$ 500.00
9/1/11	130678	Desert Hills Electric	400' 10 gauge power cable	25937	$ 464.00	$ 164,708.35	$ 400.00
9/1/11	130686	G.E. Analytical Instru.	T.O.C. Analyzer		$ 36,683.49	$ 128,024.86	$ 30,000.00
9/12/11	130679	Aquatic Eco Systems	Aspirating Aerators	25930	$ 3,939.58	$ 124,085.28	$ 3,000.00

CEHMM LEDA Application - Attachment 4b

Materials and Equipment

Project Name: Energy Innvovation - CEHMM Biodiesel Project City Account Num.: 62-621-85011

Grant No.: 09-521-A083068-003

Date	Purchase Order No.	Name of Vendor	Description	Check No.	Invoice Amount	Balance	Current Value
9/1/11	130680	Rob's Trailers	18' x 83" utility trailer		$ 3,829.00	$ 120,256.28	$ 3,000.00
9/1/11	130685	Trinity Pumps	3 - 3" pumps	25963	$ 3,002.13	$ 117,254.15	$ 2,000.00
9/1/11	130902	Cole Parmer	PH Controller, Solenoid, Electrode		$ 4,907.03	$ 112,347.12	$ 3,000.00
9/7/11	130903	Aquatic Eco Systems	Multi-Parameter Meter & Cable	25951	$ 3,104.70	$ 109,242.42	$ 2,500.00
	131210	Aquatic Eco Systems	Aerators 1 phase & 3 phase		$ 3,945.95	$ 105,296.47	$ 2,500.00
TOTAL					$ 1,017,703.53		$ 561,900.00

CEHMM LEDA Application
Attachment 1.d.

Resumes/Biographical Sketches of
CEHMM Board of Directors

Dr. Burchiel is a Professor of Pharmacology and Toxicology and the DeSantis Endowed Chair of Pharmacogenomics at the University of New Mexico Health Sciences Center (HSC) and is the Associate Dean for Research in the UNM College of Pharmacy. He directs the UNM HSC Environmental Health Signature Program and the New Mexico Center for Isotopes in Medicine. Dr. Burchiel received his Ph.D. from UC San Francisco in 1977 and has been on the faculty at UNM since 1978. He is an expert in immunotoxicology and environmental carcinogenesis. He has authored over 100 scientific manuscripts and has been continually funded by the NIH for over 20 yrs. Dr. Burchiel is an active consultant to pharmaceutical and biotech companies and is active in the development of novel radiopharmaceuticals for imaging and cancer therapy.

STEVEN P. CASTILLO

Work Address:
Klipsch School of Electrical and Computer Engineering
New Mexico State University
Dept. 3-O, Box 30001
Las Cruces, New Mexico 88003

Home Address:
501 Old Farm Rd.
Las Cruces, NM 88005

(505) 523-5343 (H)
(505) 646-3117 (W)
scastill@nmsu.edu

EDUCATION:

BSEE, August 1982 from New Mexico State University.
MSEE, February 1984 from the University of Illinois, advisor - Professor Raj Mittra.
Ph.D., June 1987 from the University of Illinois. Thesis title -"Electromagnetic Modeling of High Speed Digital Circuits," advisor - Professor Raj Mittra.

EXPERIENCE:

Dean: College of Engineering, New Mexico State University, 7/2004 to present.

Department Head: Klipsch School of Electrical and Computer Engineering, New Mexico State University, 9/99 to 6/2004.

Interim Department Head: Klipsch School of Electrical and Computer Engineering, New Mexico State University, 12/98 to 8/99.

Professor: New Mexico State University, 8/96 to present.

Associate Professor: New Mexico State University, 8/91 to 8/96.

Assistant Professor: New Mexico State University, 7/87 - 8/91.

Research Assistant: University of Illinois Electromagnetic Communications Laboratory.

Member of Technical Staff: Bell Laboratories/AT&T Information Systems in Denver, Colorado and at the University of Illinois, 9/82 - 12/83.

TECHNICAL INTERESTS:

Electromagnetic Theory, Electromagnetic Interference Problems, Numerical Solution of Electromagnetic Problems, High Performance Computing, Computational Linear Algebra

HONORS:

Eta Kappa Nu EE Honor Society
Phi Kappa Phi Honor Society
Tau Beta Pi Engineering Honor Society
Sigma Xi Scientific Research Society
National Science Foundation Presidential Young Investigator Award (1991)
NMSU Leadership in the Directions for University Computing Award (1991)
Member - The Electromagnetics Academy (1995)
Boeing Welliver Faculty Fellow (1996)
New Mexico State University Regents Professor (2004)

UNIVERSITY SERVICE

NMSU Klipsch School of Electrical and Computer Engineering Faculty Search Committee - 1988 - 1991, 1995 (chair).

NMSU Klipsch School of Electrical and Computer Engineering Department Head Search Committee - 1995 - 1996.

NMSU Klipsch School of Electrical and Computer Engineering Graduate Committee - 1996 - 1997.

NMSU Klipsch School of Electrical and Computer Engineering Computer Committee - 1996 - 1998.

NMSU College of Engineering Promotion and Tenure Committee - 1996 - 2000.

NMSU College of Engineering Dean Search Committee - 1999.

NMSU Computer Advisory Committee - 1995 - 1996 (chair).

NMSU Presidential Search Committee - 1994 - 1995.

NMSU Strategic Planning Committee - 1996 - 1998.

Speaker for the NMSU Pre-Freshman Engineering Program (PREP) - 2000, 2001, 2002, 2003.

NMSU Provost Search Committee - 2001.

NMSU Graduate Dean Search Committee - 2002.

NMSU Vice-Provost for Enrollment Management Search Committee - 2002.

NMSU Honorary Degree Committee - 2002 - 2003.

NMSU Danny Villanueva Scholarship Breakfast Committee - 2002 - 2003.

Participant in NMSU high school honors night programs - 2000, 2001, 2002, 2003.

COMMUNITY SERVICE

Adventures in Supercomputing Mentor for Las Cruces High School - 1995.

Adventures in Supercomputing Judge - 1996.

Holy Cross Catholic School Computer Advisory Committee - 1996 - 1998.

Leadership New Mexico - 2000 - 2001.

Southern New Mexico Regional Science Fair Judge - 2001.

Mentor to Holy Cross Catholic School NM BEST (Boosting Engineering, Science, and Technology) 7th grade team, 2001.

High Technology Consortium of Southern New Mexico charter member - 2001 - present.

"Electrical Engineering as a Career" seminar for LCHS, Mayfield HS, Onate HS, Alamogordo HS, Eldorado HS, Academy HS, Gadsden HS, Belen HS - 2000, 2001, 2002, 2003.

Pre-Freshman Engineering Program (PREP) Principle Investigator - 2002, 2003. This program brings 140 middle school students to NMSU for seven weeks each summer to study math, science, and engineering.

MAJOR DEVELOPMENT ACTIVITIES AS DEPARTMENT HEAD

Las Cruces PreFreshman Engineering Program - grant from the Intel Foundation, $50,000 in both 2002 and 2003.

Klipsch School Wireless Systems Laboratory - grant from Agilent, $80,775 (PI - Russell Jedlicka).

Klipsch School Microwave VLSI Laboratory - grant from Agilent, $118,000 (PI - Jaime Ramirez-Angulo).

Klipsch School Texas Instruments Graduate Fellows - grant from Texas Instruments, $225,000 (PI - Jaime Ramirez-Angulo).

Klipsch School Computer Laboratory - grant from Hewlett Packard, $134,000 (with Computer Science).

Klipsch School HP rp8400 Supercomputer - donation from Hewlett Packard, $387,000.

Public Service Company of New Mexico Distinguished Chair in Utility Management - donation from Public Service Company of New Mexico and the PNM Foundation, $625,000.

Paul W. and Valerie Klipsch Distinguished Professorships, donation from Valerie Klipsch, $500,000 (PI - Joe Creed).

Hewlett Packard School of Education and K-12 Technology Collaboration Grant, grant from Hewlett Packard for a mobile computer classroom at Lynn Middle school which is an Engineering Magnet School for the Las Cruces Public School System, $140,000 (PI's - Susan Brown and Rebecca Sellars).

PROFESSIONAL ACTIVITIES:

Sandia National Laboratories Advanced Strategic Computing Initiative (ASCI) External Review Panel - 2001 - 2003.

Sandia National Laboratories Computational Sciences External Review Panel - 2001.

Associate Editor - IEEE Transactions on Antennas and Propagation (1999 - 2003).

Senior Member - The Institute of Electrical and Electronics Engineers

Member - Microwave Theory and Techniques Society (IEEE)

Member - Antennas and Propagation Society (IEEE)

Member - Electromagnetic Compatibility Society (IEEE)

Member - Circuits and Systems Society (IEEE)

TEACHING:

Signals and Systems (Undergraduate)
AC Circuits (Undergraduate)
Electromagnetics I (Undergraduate)
Electromagnetics II (Undergraduate)
Electromagnetic Theory I (Graduate)
Electromagnetic Theory II (Graduate)
Antenna Theory (Graduate)
Computational Electromagnetics (Graduate)

ADVISING ACTIVITIES

NMSU Klipsch School of Electrical and Computer Engineering Crimson Scholar advisor - 1990 - present.

NMSU Society for Hispanic Professional Engineers advisor - 1990 - 1996.

NMSU Cycling Team advisor - 1994 - present.

Master of Science Degree Students graduated - 18 (all thesis option).

Doctor of Philosophy Degree Students graduated - 5.

PAPERS (CONFERENCE):

R. Jedlicka, B. Lail, and S. Castillo, "Electromagnetic Coupling Through Slot Apertures Into Cavities with Loaded Wires", accepted for presentation at the 2003 IEEE International Symposium on Antennas and Propagation.

S. Castillo, "Assessing Faculty Performance in a Land-Grant Institution", Invited paper presented at the 2003 NMSU Science, Engineering and Technology Education Conference, January, 2003.

S. Castillo, B. Lail, and R. Jedlicka, "Efficient Computational Models of Electromagnetic Coupling through General Tortuous-Path, Narrow-Slot Apertures Into Shielded Systems", Invited paper in the proceedings of the 2002 IEEE International Symposium on Antennas and Propagation, July, 2002.

B. Lail and S. Castillo, "A Hybrid MoM/FEM Model of Coupling to Thin-Wire Structures in Complex Cavities", Proceedings of the 2002 IEEE International Symposium on Antennas and Propagation, July, 2002.

B. Lail and S. Castillo, "Electromagnetic Coupling to Thin-Wire Structures in Complex Cavities", Proceedings of the 2001 IEEE International Symposium on Antennas and Propagation, July, 2001.

W. Dearholt, S. Castillo, and D. Barnes, "Direct Solution of Large, Sparse Systems of Equations on a Distributed Memory Computer," accepted for presentation at the 2002 International Conference on Parallel and Distributed Processing Techniques and Applications (PDPTA'2002:2002).

G. Hennigan and S. Castillo, "Open-Region, Electromagnetic Finite-Element Scattering Calculations in Anisotropic Media on Parallel Computers", Proceedings of the 1999 IEEE International Symposium on Antennas and Propagation, July, 1999.

S. Buckles and S. Castillo, "The Use of Meshless Methods for Solving Electromagnetic Vector Scattering problems," Proceedings of the 1999 IEEE International Symposium on Antennas and Propagation, July, 1999.

S. Buckles and S. Castillo, "The Application of Meshless Methods to the Numerical Solution of Transient Electromagnetic Field Problems," Proceedings of the 1998 IEEE International Symposium on Antennas and Propagation, July, 1998.

B. Lail and S. Castillo, "Electromagnetic Coupling Through Narrow Slot Apertures Into a Half-Space Containing a Conducting Element," Proceedings of the 1998 IEEE International Symposium on Antennas and Propagation, July, 1998

R. H. Bishop, S. Castillo, R. Kapania, R. Logendran, T. Mouch, J. Oliver, D. Pacey, A. Rodriguez, O. Savas, V. Syrmos, R. Talreja, "Engineering Education: A Vision for Change," Proceedings of the 1997 joint AIAA/SAE international conference, 1997, paper written for the Boeing Welliver Faculty Fellow Program.

R.H. Bishop, S.P. Castillo, R.K. Kapania, R. Logendran, T.N. Mouch, J.H. Oliver, D.A. Pacey, A.A. Rodriguez, O. Savas, V.L. Syrmos, R.R. Talreja, "

Engineering Education: A Vision For Change, " 1996 World Aviation Congress, October 21-24, 1996, Los Angeles, CA, AIAA Paper No. 965543, Invited Paper.

J. Loukota, S. Castillo, J. Millard, and R. Jedlicka, "Analysis of Large Cavity Field Problems Using a Finite Element Formulation of the Connection Scheme," Proceedings of the 1997 International IEEE/AP-S Symposium.

S. Castillo, "The Interpretation of Body Current Distributions in Designing of Low-RCS Scatterers," Proceedings of the 1997 International IEEE/AP-S Symposium.

W. Dearholt, S. Castillo, and V. Bokil, "Finite Element Solution of Scattering Problems on a Massively Parallel Computer," Proceedings of the 1996 International IEEE/AP-S Symposium.

R. Jedlicka and S. Castillo "Electromagnetic Coupling into Complex Cavities Through Narrow Slot Apertures Having Depth and Losses," Proceedings of the 1996 International IEEE/AP-S Symposium.

W. Dearholt, S. Castillo, and G. Hennigan, "Solution of Large Sparse Irregular Systems on a Massively Parallel Computer," Proceedings of the Irregular '96 - Parallel Algorithms for Irregularly Structured Problems conference, August, 1996.

S. Castillo, J. Martinez, and W. Dearholt, "The Performance of Linear Algebra Routines on a Distributed Memory Massively Parallel Computer," Proceedings of the 1995 International IEEE/AP-S Symposium, 1995.

S. Castillo, H. DeAguila, and T. Loughry, "Analysis of Coupling Through Shielded Apertures," Proceedings of the 1995 International IEEE/AP-S Symposium, 1995.

S. Castillo and G. Hennigan, "Finite Element Analysis On Message-Passing Parallel Computers," Proceedings of the 1994 annual Electromagnetic Code Consortium (EMCC) meeting, May, 1994.

R. Jedlicka and S. Castillo, "A Hybrid Finite Element/Moment Method for Solving Three-Dimensional Electromagnetic Coupling Problems," presented at the 1994 Fulmen 6 conference, May 1994.

S. Omick and S. Castillo, "Elimination of Numerical Dispersion in Finite-Difference and Finite-Element Time-Domain Solutions to Maxwell's Equations," presented at the 1994 Fulmen 6 conference, May 1994.

S. Omick and S. Castillo, "An Efficient Time-Domain Taylor-Galerkin Finite Element Formulation," Proceedings of the 1994 International IEEE/AP-S Symposium, 1994.

S. Omick and S. Castillo, "Elimination of Numerical Dispersion in Finite-Difference Time-Domain Algorithms", Proceedings of the 1993 International IEEE/AP-S Symposium, 1993.

R. Jedlicka and S. Castillo, "Electromagnetic Penetration of Cavity-Backed Apertures with Internal Loading", Proceedings of the 1993 International IEEE/AP-S Symposium, 1993.

R. Jedlicka and S. Castillo, "Coupling Through Deep, Tortuous Path and Bolt-Loaded Narrow Slot Apertures with Depth and Loss", Proceedings of the 1993 International IEEE/AP-S Symposium, 1993.

S. Omick and S. Castillo, "A 3D FDTD Formulation Using Flux-Corrected Transport for Accurate Modeling of Transient Electromagnetic Phenomena," Proceedings of the 1992 International IEEE/AP-S Symposium, 1992.

K. Dalton, S. P. Castillo, K. T. Ng, and E. C. Hensel, "Finite Difference Solution of Semiconductor Device Problems on a SIMD Computer," presented at the Permian Basin Supercomputing Conference, Odessa, TX, March 1992.

R. Jedlicka and S. Castillo, "A Hybrid Finite Element/Boundary Element Method for Solving Three-Dimensional Electromagnetic Coupling Problems," Proceedings of the 1991 International IEEE/AP-S Symposium, 1991.

S. Omick, S. Castillo, and R. Hills, "The Application of Flux Corrected Transport to Transient Electromagnetic Phenomena," Proceedings of the 1991 International IEEE/AP-S Symposium, 1991.

R. Jedlicka, S. Castillo, and L. Warne, "Experimental Study of Narrow Slot, Cavity-Backed Apertures with Finite Wall Conductivity," Proceedings of the 1991 International IEEE/AP-S symposium, 1991.

K. Dalton, E. Hensel, S. Castillo, K. Ng, "The Finite Difference Solution of Two- and Three-Dimensional Semiconductor Problems on the Connection Machine," Proceedings of the Sixth Distributed Memory Computer Conference, pp. 466 - 469, 1991.

G. Hennigan, S. Castillo, E. Hensel, "Using Domain Decomposition to Solve Positive-Definite Systems on the Hypercube Computer," Proceedings of the Sixth Distributed Memory Computer Conference, pp. 462 - 465, 1991.

S. Castillo, R. Jedlicka, "A Hybrid Finite ElementBoundary Element Method for Solving Three-Dimensional Electromagnetic Coupling Problems," invited paper, Proceedings of the 1991 Progress In Electromagnetics Research Symposium, 1991.

S. Castillo, "Accuracy of the Finite Element Method For Solving Open-Region Scattering Problems," Proceedings of the Summer 1990 IEEE International Symposium on Antennas and Propagation.

R. Jedlicka and S. Castillo, "Experimental Study of Narrow Slot Apertures Having Depth," Proceedings of the 1990 IEEE International Symposium on Antennas and Propagation.

S. Hutchinson, S. Castillo, E. Hensel, "The Finite Element Solution of Two-Dimensional Transverse Magnetic Scattering Problems on the Connection Machine," Proceedings of the Fifth Distributed Memory Computing Conference, April, 1990.

T. Rogers and S. Castillo, "An Investigation of Absorbing Boundary Conditions As Applied to the Finite Element Solution of 2-D Open Region Electrostatic

Problems," Proceedings of the Summer 1989 IEEE AP/URSI International Symposium, June, 1989.

S. Castillo and A. F. Peterson, "Solution of the 3-D Vector Wave Equation In an Open-Region Using the Finite Element Method," Summer 1989 IEEE AP/URSI International Symposium, June, 1989.

S. Hutchinson, S. Castillo, and E. Hensel, "Solving 2-D Electrostatic Problems on the Connection Machine Using the Finite Element Method," Fifth Annual Review of Progress in Applied Computational Electromagnetics, March, 1989.

C. Koesoemodiprodjo, E. Hensel, and S. Castillo, "Multigrid Solution of the 2-D Transient Euler Equations on the CM-2," Proceedings of the 1989 SIAM Conference on Parallel Processing for Scientific Computing, 1989.

S. Hutchinson, S. Castillo, and E. Hensel, "A Basic Finite Element Code on the Connection Machine," Proceedings of the Fourth Conference on Hypercube Concurrent Computers and Applications, March, 1989.

G. Hennigan, S. Castillo, and E. Hensel, "Feasibility of the FFT Applied to the Transient Solution of Field Problems Using Finite Elements," Proceedings of the Fourth Conference of Hypercube Concurrent Computers and Applications, March, 1989.

G. Hennigan, S. Castillo, and E. Hensel, "The Finite Element Method with Domain Decomposition on an FPS T-Series Hypercube," Proceedings of the Fourth Conference on Hypercube Concurrent Computers and Applications, March, 1989.

S. Castillo and A. F. Peterson, "An Investigation of 3-D EM Scattering Problems Using the Finite Element Method," Summer 1988 IEEE AP/URSI International Symposium, June 1988.

S. Castillo and E. Hensel, "Numerical Solution of Differential Equations in Mechanical and Electrical Engineering Field Problems on the Hypercube Parallel Computer," invited paper for the 1988 Far-West Sectional Meeting of the American Mathematical Society, April, 1988.

A. F. Peterson and S. Castillo, "Relative Accuracy of Frequency-Domain Integral and Differential Equation Formulations for Open-Region Electromagnetic Scattering Problems," invited paper for the 1988 National Radio Science Meeting, January 1988.

S. Castillo, C. Chan, R. Mittra, "Analysis of Multiconductor Transmission Line Systems With Non-Linear Loads With Application to CAD Design of Digital Circuits," - 1986 IEEE International Symposium on Electromagnetic Compatibility, September 1986.

Z. Pantic, S. Castillo, R. Mittra, "Applications of the Finite Element Method For Electromagnetic Modeling of High Speed Digital Circuits," - Summer 1986 IEEE AP/URSI International Symposium, June 1986.

C. Chan, S. Castillo, R. Mittra, "Some Aspects of Active Array Antenna System Design For Satellite Applications," Proceedings of ISAP, 1985.

S. Castillo, C. Chan, R. Mittra, "Analysis of N-Conductor Transmission Line Systems With Non-linear Loads," Summer 1985 IEEE AP/URSI International Symposium, June 1985.

PAPERS (JOURNAL):

B. Lail, S. Castillo and R. Jedlicka, "Coupling Through Narrow-Slot Apertures to Thin-Wire Structures in Complex Cavities," submitted to the *IEEE Transactions on Antennas and Propagation*, in review.

W. Dearholt and S. Castillo, "The Finite Element Solution of Electromagnetic Scattering Problems Using A Parallel, Portable, Scalable, Direct LU Solver," to be submitted to the *Journal of the Applied Computational Electromagnetics Society*, in preparation.

S. Buckles and S. Castillo, "An Adaptive Meshless Method for Solving Transient Electromagnetic Scattering problems," submitted to the *IEEE Transactions on Antennas and Propagation*, in revision.

B. Lail and S. Castillo, "Coupling Through Narrow-Slot Apertures to Thin-Wire Structures," *IEEE Transactions on Electromagnetic Compatibility*, Vol. 42, No. 3, pp. 276-283, August, 2000.

R. Jedlicka, S. Castillo, L. Warne, "Coupling Through Tortuous Path, Narrow Slot Apertures into Complex Cavities," *IEEE Transactions on Antennas and Propagation*, Vol. 48, No. 3, pp. 456-466, March, 2000.

R.H. Bishop, S.P. Castillo, R.K. Kapania, R. Logendran, T.N. Mouch, J.H. Oliver, D.A. Pacey, A.A. Rodriguez, O. Savas, V.L. Syrmos, R.R. Talreja, " Engineering Education: A Vision For Change, " submitted for publication in the ASEE Journal of Engineering Education.

J. P. Basart, J. O. Burns, B. K. Dennison, K. W. Weiler, N. E. Kassim, S. P. Castillo, and BM McCune, "Directions for Space-Based Low Frequency Radio Astronomy, Part I: System Considerations,", *Radio Science*, Vol. 32, No. 1, pp. 251-263, Jan-Feb, 1997.

J. P. Basart, J. O. Burns, B. K. Dennison, K. W. Weiler, N. E. Kassim, S. P. Castillo, and BM McCune, "Directions for Space-Based Low Frequency Radio Astronomy, Part II: System Considerations,", *Radio Science*, , Vol. 32, No. 1, pp. 265-275, Jan-Feb, 1997.

S. Omick and S. Castillo, "Error Characterization for the Time-Domain Numerical Solution of Maxwell's Equations," invited paper,*IEEE Antennas and Propagation Newsletter 'EM-Programmer's Column'*, Vol. 36, No. 5, Oct. 1994.

S. Castillo and S. Omick, "Suppression of Dispersion in FDTD Solutions of Maxwell's Equations," *Journal of Electromagnetic Waves and Applications*, Vol. 8, No. 9/10, pp. 1193-1221, Nov. 1994.

A. F. Peterson and S. Castillo, "A Frequency-Domain Differential Equation Formulation For Electromagnetic Scattering From Inhomogeneous Cylinders," in

Finite Elements for Wave Electromagnetics - Methods and Techniques, Ed. by Peter P. Silvester, IEEE Press, 1994.

S. Omick and S. Castillo, "A New Finite-Difference Time-Domain Algorithm for the Accurate Modeling of Wide-Band Electromagnetic Phenomena," *IEEE Trans. on EMC*, Vol. 35, No. 2, May 1993.

G. Hennigan, S. Castillo, Edward Hensel, "Using Domain Decomposition to Solve Symmetric, Positive-Definite Systems on the Hypercube Computer," *International Journal for Numerical Methods in Engineering*, vol. 33, pp. 1941-1954, 1992.

S. Hutchinson, E. Hensel, S. Castillo, K. Dalton, "The Finite Element Solution of Elliptical Systems on a Data Parallel Computer," *International Journal for Numerical Methods in Engineering*, vol. 32, pp. 347-362, 1991.

S. Castillo, Z. Pantic, and R. Mittra, "Finite Element Analysis of Multiconductor Printed Circuit Transmission Line Systems," *International Journal for Numerical Methods in Engineering*, vol. 29, pp. 1033-1047, 1990.

A. F. Peterson and S. Castillo, "A Frequency-Domain Differential Equation Formulation For Electromagnetic Scattering From Inhomogeneous Cylinders," *IEEE Trans. Antennas Propagat.*, vol. AP-37, No. 5, May 1989.

A. F. Peterson and S. Castillo, "Differential-Equation Methods for Electromagnetic Scattering From Inhomogeneous Cylinders," *Radar Cross Sections of complex Objects*, Ed. by W. Ross Stone, IEEE Press, 1990.

GRANTS AND SPONSORED RESEARCH:

"Pre-Freshman Engineering Program, 2003 Proyecto Access" The University of Texas at San Antonio and NASA, 3/2002 - 9/2002, **$80,000**, (Co-PI).

"Pre-Freshman Engineering Program, 2002 Proyecto Access" The University of Texas at San Antonio and NASA, 3/2002 - 9/2002, **$80,000**, (PI).

"Management of Dynamic and Irregular Parallelism in Symbolic and Scientific Computing, NSF CISE Infrastructure Program, 8/98 - 7/2002, **$1.3 million**, (Co-PI).

"VBNS Connection for NMSU," NSF CISE, 1/98 - 12/2002, **$500,000**, (Co-PI).

"A Commodity-Based Parallel System for Computational Science and Engineering," National Science Foundation, 12/97 - 12/98, **$75,000** (Co-PI).

"Development of a Complex Version of Aztec," Sandia National Laboratories, 10/1/97 - 3/1/98, **$30,000**, (PI).

"Solving the Sparse Systems of Equations that Results from Finite-Element Methods on a Massively Parallel Computer (continuation)," **$36,000**, Sandia National Laboratories, 11/97 - 3/98 (PI).

"A Compute Server for Computational Engineering," $**225,395**, Army Research Office, 3/97 (PI).

"Solving the Sparse System of Equations that Results from Finite-Element Methods on a Massively Parallel Computer (continuation)," **$72,000** , Sandia National Laboratories, 11/96 - 10/97 (PI).

"Modeling and Analysis of Electromagnetic Coupling Through Apertures into Complex Systems," **$178,000**, The Army Research Office, 3/96 - 2/99 (PI).

"Solving the Sparse System of Equations that Results from Finite-Element Methods on a Massively Parallel Computer (continuation)," **$70,836**, Sandia National Laboratories, 11/95 - 10/96 (PI).

"Investigation of Low Frequency Pylon-Target Interactions at RAMS - Phase II," **$46,000**, Holloman Air Force Base/EG&G Corp., 2/95 - 8/95 (PI).

"Solving the Sparse System of Equations that Results from Finite-Element Methods on a Massively Parallel Computer (continuation)," **$70,755**, Sandia National Laboratories, 11/94 - 10/95 (PI).

"Computation of Eigenvalues and Eigenmodes for Waveguides of Arbitrary Cross-Section," **$21,300**, The Boeing Company, 10/94 - 5/95 (PI).

"An Investigation of the Application of Flux-Correction Methods for Reducing Dispersion in the Yee FDTD Algorithm," **$50,000**, Phillips Laboratories/Kaman Sciences Corp., 11/93 - 9/94 (PI).

"Solving the Sparse System of Equations that Results from Finite-Element Methods on a Massively Parallel Computer," **$71,602**, Sandia National Laboratories, 11/93 - 10/94 (PI).

"Computational Field Simulation on Massively Parallel Supercomputers," **$225,000**, NASA, 5/94 - 9/98 (PI).

"Investigation of Low Frequency Pylon-Target Interactions at RAMS," **$68,000**, Holloman Air Force Base/EG&G Corp., 10/93 - 8/94 (PI).

"New Mexico Alliance for Minority Participation," **$4,998,955**, NSF, 10/93 - 9/98 (Co-PI).

"Analysis of Coupling Through Narrow Slot Apertures Into Complex Systems," **$50,000**, Phillips Laboratories/Kaman Sciences Corp., 1/93 - 12/93 (PI).

"Improvement of Reliability of Electronic Subsystems," (continuation) **$219,982**, NSF, 10/92 - 10/95 (PI)

"Undergraduate Computer-Aided Electromagnetics and Microwave Laboratory," **$52,229**, NSF, 9/1/92 - 2/28/95 (Co-PI).

"Experimental Investigation of Electromagnetic Coupling into Large Conducting Cavities," **$40,742**, Sandia National Laboratories, 1/92 - 9/92 (PI).

"Development of Device Models for CMOS Circuits," **$147,366**, Department of Defense, 10/91 - 9/93 (PI).

"Presidential Young Investigator Award," up to **$62,500/yr**, National Science Foundation, 10/91 - 9/96, (PI).

"Analytical and Numerical Analysis of Broadband Electromagnetic Coupling into Complex Systems," **$56,253**, Army Vulnerability Assessment Laboratory, 2/91 - 2/92 (PI).

"A Departmental SUN 4/280 Compute Server for the Electrical and Computer Engineering Department," **$173,000**, Sun Microsystems (PI).

"Improvement of VLSI Design Systems at New Mexico State University," **$10,000**, ATT (Co-PI).

"Experimental and Theoretical Investigations of Cavity Backed Slots With Internal Loading," **$225,000**, Sandia National Laboratories, 12/90 - 9/91 (PI).

"Detection of the Number of Sutures and Needles in a Package Using Low-Level Magnetic Fields," **$15,383**, Ethicon Inc., 4/90 - 9/90 (Co-PI).

"Experimental Electromagnetic Characterization of Narrow Slot Apertures Having Depth - Continuation," **$100,000**, Sandia National Labs, 10/89 - 9/90 (PI).

"Three-Dimensional Modeling of Electromagnetic Field Coupling into Complex Cavities - Continuation," **$30,000**, Sandia National Laboratories, 11/89 - 10/90 (PI).

"Improvement of Reliability of Electronic Subsystems," $216,000, NSF, 10/88 - 10/91 (PI).

"Three-Dimensional Modeling of Electromagnetic Field Coupling into Complex Cavities," **$30,000**, Sandia National Labs, 11/88 - 10/89 (PI).

"Experimental Electromagnetic Characterization of Narrow Slot Apertures Having Depth," **$103,000**, Sandia National Labs, 12/88 - 9/89 (PI).

"The Numerical Solution of Differential Equations in Mechanical and Electrical Engineering Field Problems on the Hypercube Parallel Computer," **$60,000**, NSF, 1/89 -8/90 (PI).

"Finite Element Solution of Partial Differential Equations on Parallel Supercomputers," **$15,035**, Digital Equipment Corporation, 5/89 - 8/90 (PI).

"Application of Supercomputing to the Solution of Large Electromagnetic Field Problems," IBM, **$5000**, 1/88 - 12/88 (PI).

"Application of Supercomputing to the Solution of Large Electromagnetic Field Problems," National Center for Supercomputing Applications - University of Illinois, 30 hrs Cray XMP/48 CPU time (PI).

Dr. Vimal Chaitanya is the Vice President for Research, Graduate Studies, and International Programs and Professor of Mechanical Engineering and Chemical Engineering at New Mexico State University. Prior to joining NMSU, Dr. Chaitanya was the Director of the Advanced Materials Processing and Analysis Center (AMPAC) and Director of Materials Characterization Facility (MCF) at the University of Central Florida, where he was a Professor of Mechanical, Materials and Aerospace Engineering. Dr. Chaitanya's active research areas include materials characterization, material degradation and failure analysis. His significant technical contribution ranges from life prediction of thermal barrier coatings for gas turbines to chemical mechanical polishing for multi-layer electronic device fabrication. He has published about 90 technical papers and has received research funding from competitive sources such as DARPA, DOE, NASA, NSF, NIST, Siemens-Westinghouse and Lucent Technologies.

In his current position, Dr. Chaitanya serves on the University Executive Committee, Administrative Council and Academic Dean's Council of New Mexico State University. He is a board member of the New Mexico Consortium Inc., New Mexico Research Consortium Inc., New Mexico Computing Applications Center and Center of Excellence for hazardous Materials Management. Professionally he serves on the board of the Dielectric Sciences and Technology Division and Education Committee of the Electrochemical Society.

Dr. Chaitanya holds a Ph.D. in Materials Science and Engineering from the Johns Hopkins University, a Masters in Bioengineering from Clemson University, and a Bachelor of Engineering in Mechanical Engineering from MSU.

ROBERT H. FORREST, SR.
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505-885-9571

EDUCATION

- Graduate of Carlsbad High School
- Gradate of Texas Western University (now UTEP) with a Bachelor of Business Arts Degree

BUSINESS

- Co-owner of Forrest Tire Company headquartered in Carlsbad with stores in Hobbs, Roswell, Lovington and Clovis, New Mexico and Odessa and El Paso, Texas
- Owner of Stevens Inn, Carlsbad, New Mexico
- Other interests include ranching, banking and motels
- Chairman of the Board for Carlsbad National Bank

CIVIC

- Elected Mayor of the City of Carlsbad, New Mexico in March 2002. Also, served as Mayor from March 1986 to March 1994
- Served as City Councilman for the City of Carlsbad, New Mexico from 1981 to 1986
- Member of Elks Lodge, Eddy and Lake Arthur Masonic Lodges and Carlsbad Shrine Club
- Foundor and President of CARC Farm and Washington Ranch, Inc.
- Membor of 1st United Methodist Church
- Honored as Employer of the Yoar and Citizen of the Year by the New Mexico Association for Retarded Citizens in 1977
- Honored as Employer of the Year by Carlsbad Jaycees in 1978
- Honored as Citizen of the Year by State Realtor's Association in 1980
- Honored as Man of the Year for New Mexico by the Small Business Administration in 1982
- Received Carlsbad Foundation's A. J. Crawford Humanitarian Award in 1985
- Served as New Mexico State Game and Fish Commissioner from 1972 to 1984
- Served as President of the Carlsbad Department of Development in 1995
- Served as President of the Riverwalk Recreation Center Advisory Board in 1995-96
- Served as Chairman of the Governor's Highway Task Force in 1995-96

PERSONAL

- Married to Barbara Perini Forrest
- Three sons
- Five grandchildren
- Born June 12, 1935

William M. Hadley, Ph.D.
Curriculum Vitae
March 2004

PERSONAL INFORMATION

Date and Place of Birth: June 4, 1942, San Antonio, Texas

Professional Address: College of Pharmacy
University of New Mexico
Albuquerque, New Mexico 87131
505-272-3241
wmhadley@aol.com

Married: Jane Walsh, October 13, 1990

ACADEMIC AND PROFESSIONAL INFORMATION

Education

1/71 - 8/72	Purdue University, Ph.D., Pharmacology/Toxicology
9/67 - 1/71	Purdue University, M.S., Pharmacology
8/63 - 6/67	Purdue University, B.S., Pharmacy
9/60 - 6/62	Purdue University, Chemical Engineering, Transferred to Pharmacy

Professional experience

10/02 -	Senior Scientist, Lovelace Respiratory Research Institute Albuquerque, NM
10/91 -7/02	Adjunct Scientist, Inhalation Toxicology Research Institute (Lovelace Respiratory Research Institute), Albuquerque, NM
7/02 -	Professor and Dean Emeritus, University of New Mexico
7/86 – 7/02	Dean, College of Pharmacy, University of New Mexico
2/85 - 7/85	Acting Dean, College of Pharmacy, University of New Mexico
7/84 - 7/86	Assistant Dean for Academic Affairs and Graduate Programs, College of Pharmacy, University of New Mexico.
7/82 – 7/02	Professor of Pharmacy (Pharmacology /Toxicology), tenured, College of Pharmacy, University of New Mexico.
1/81 - 1/82	Visiting Scientist, Inhalation Toxicology Research Institute, Albuquerque, New Mexico.
7/76 - 6/82	Assoc. Professor of Pharmacy (Pharmacology/Toxicology) tenured, College of Pharmacy, University of New Mexico.

8/72 - 7/76	Assistant Professor of Pharmacy, (Pharmacology/Toxicology), College of Pharmacy, University of New Mexico, Albuquerque, New Mexico.
11/70 - 8/72	Environmental Health Trainee, Purdue University, West Lafayette, Indiana.
2/69 - 11/70	NDEA Title IV Research Fellow in Pharmacology, Purdue University, West Lafayette, Indiana.
9/68 - 2/69	Graduate Teaching Assistant Grade II, Purdue University, West Lafayette, Indiana.
6/68 - 9/68	Research Assistant, Purdue University, West Lafayette, Indiana.
9/67 - 6/68	Graduate Teaching Assistant Grade I, Purdue University, West Lafayette, Indiana.
6/67 - 9/67	Apprentice Pharmacist, Wells Yeager Best Drugs, Lafayette, Indiana.
6/66 - 9/66	Apprentice Pharmacist, Hooks Drugs, Columbus, Indiana.
5/63 - 9/63	Clerk, Coffman Drugs, Columbus, Indiana.

Teaching experience

While at the University of New Mexico, I have developed and taught the following courses:

Pharmacy 482: Clinical Toxicology.
Pharmacy 584L: Analytical Toxicology.
Pharmacy 487/587: Pollution Toxicology.
Pharmacy 485/585L: Biochemical Pharmacology/Toxicology.

I have taught all or part of the following courses:

Pharmacy 373: Pharmacology I.
Pharmacy 480/580: General Toxicology
Pharmacy 497 and 498: Laboratory and Library Projects in Pharmacy.
Many other lectures given in various courses

Management training seminars attended

Persuasive Presentations, Richard J. Kulda, Professional Eloquence, Orange, CA 92669, April 24, 1981.
Management Effectiveness Workshop, Milton Garrett, UNM Management Development and Training Program, Albuquerque, NM 87131, November 3-6, 1986.
Enhancing Executive Leadership in Schools of Pharmacy, American Association of Colleges of Pharmacy, San Diego, CA, February 18, 19, 1988.

Legislative Workshop, American Association of Colleges of Pharmacy, San Diego CA, February 19, 1988.
Advanced Situational Leadership, Milton Garret, UNM Management Development and Training Program, Albuquerque, NM 87131, December 16, 1988.
Dr. Lloyd H. Elliott, University Administration (Observations of a Lifelong Educator), Teleconference, George Washington University Continuing Engineering Education, December 20, 1988.
Increasing Human Effectiveness, Managing the Rapids of Change, UNM Management Development and Training Program, Albuquerque, NM, January 3-5, 1990.
Managing with Humor, UNM Management Development and Training Program, Albuquerque, NM December 4, 1990.
Management of Change, AACP/ICI Pharmaceuticals Group Symposium, Washington, D.C., Feb. 28 - March 2, 1991.
Power, Influence, and Strategic Planning, AACP/ICI Pharmaceuticals Group Symposium, Amelia Island Plantation, FL, Feb. 27-29, 1992.
Health Sciences CQI Retreat, La Posada Hotel, January 12, 1994
AACP Academic Management Symposium, Implementing Change: Programs, Politics, and Polemics, ANA Hotel, Washington, DC, March 2 -4, 1995.
Dispute Resolution/Performance Management Seminar, UNM Employee and Organizational Development, Albuquerque, Sept. 13, 1995
AACP Academic Management Symposium, Costa Mesa, CA, March 3-5, 1996.
Managing and Implementing Change, UNM Employee and Organizational Development, Albuquerque, May 9, 1996
AACP Academic Management Symposium, College/Faculty Entrepreneurship, Washington, DC, March 3–5, 1997
AACP Academic Management Symposium, Partnerships with Practice, Savannah, Georgia, February 15-17, 1998
AACP Academic Management Symposium, Washington, DC, Taking Your Skills to the Hill, February 25-27, 1999
Civil Rights at Work at the University of New Mexico, WWW exercises and class, May 1999
AACP Academic Management Symposium, "Leadership for Institutional Progress", Richmond, VA, Leadership, February 24 - 26, 2000

HONORS

Pendragon, Purdue University Undergraduate Service Honorary
Rho Chi, Pharmacy scholastic honor society
Merck Sharp and Dohme Award as the best pharmacology student, 1967
NDEA title IV fellowship in pharmacology
Fundamental and Applied Toxicology Editorial Board 1987 - 1989
Pharmaceutical Manufacturers Association Visiting Professor, 1987
Vice President Elect, Rocky Mountain Chapter, Society of Toxicology 1988-1989.

Vice President Rocky Mountain Chapter, Society of Toxicology 1989-1990.
President, Rocky Mountain Chapter, Society of Toxicology 1990-1991
Purdue University School of Pharmacy and Pharmacal Sciences Distinguished Alumnus Award, 1995
Bowl of Hygeia, Public Service Award, New Mexico Pharmaceutical Association, 1998
At various times I have been listed in Who's Who in Education, Who's Who in the West, American Men & Women of Science, Who's Who in Science and Engineering, Who's Who in Health Care and Who's Who in America

SOCIETIES AND ORGANIZATIONS

Alpha Zeta Omega (Honorary)
American Association for the Advancement of Science
American Association of Colleges of Pharmacy
American Pharmaceutical Association
Austin's Old 300
Kappa Psi
New Mexico Pharmaceutical Association
Rocky Mountain Chapter of the Society of Toxicology
Rho Chi
Society of Toxicology
Southwestern Association of Toxicologists
Western Pharmacology Society
Registered Pharmacist (Indiana - 1967-1976)

RESEARCH PUBLICATIONS AND PRESENTATIONS

1. Hadley, W. M., An Investigation of Possible Pathways for the Action of Chlorpromazine on Melanin Formation Using the Harding-Passey Melanoma. M.S. Dissertation, Purdue University (January 1971). (Major Professors, T.S. Miya and W. F. Bousquet).
2. Hadley, W. M., Bousquet, W. F., and Miya, T. S., A Simplified Fluorometric Assay for Oxidized and Reduced Glutathione in Tissue. Presented at the Federation of American Societies for Experimental Biology, Spring Meeting (April 12-17, 1971).
3. Hadley, W. M., Bousquet, W. F., and Miya, T. S., A Modified Fluorescen ce Assay for Oxidized and Reduced Glutathione in Tissue. J Pharm Sci 63:57-59 (1974).
4. Hadley, W. M., and Miya, T. S., Cadmium Potentiated Hexobarbital Sleep Time in Male and Female Albino Rats and Mice. Presented at the Society of Toxicology meeting (March 5-9, 1972).
5. Hadley, W. M., The Effect of Cadmium Acetate on In Vivo and In Vitro Drug Metabolism. Ph.D. Thesis, Purdue University (August, 1972). (Major Professor - T. S. Miya).

6. Hadley, W. M., Miya, T. S., and Bousquet, W. F., Cadmium Inhibition of Hepatic Drug Metabolism in the Rat. Tox and Applied Pharmacol 28:284-291 (1974).
7. Ulibarri, L. F., and Hadley, W. M., Cadmium Inhibition of Microsomal Drug Metabolism: Investigation of the Mechanism. MBRS Symposium, New Orleans (March 25, 1976).
8. Rail, C. D. and Hadley, W. M., Selenium in Water: An Overview. J Environ Hlth 39(3):173-175 (1976).
9. Merrick, B. A., and Hadley, W. M., The Effects of Large Doses of Atropine Sulfate on Heart Rate and Blood Pressure in Rats. Presentation to the Graduate Student Forum, University of Nebraska (Fall, 1978).
10. Merrick, B. A., Holcslaw, T. L., and Hadley, W. M., Cardiovascular Effects of Large Doses of Atropine Sulfate on Heart Rate and Blood Pressure in Rats. Presented at the ASPET meeting, Portland Oregon (August, 1979).
11. Merrick, B. A., Hadley, W. M. and Holcslaw, T. L., The Effect of Large Doses of Atropine Sulfate in Rats. Res Comm Chem Pathol Pharmacol 25(1):13-21 (1979).
12. Fossa, A. A., Hadley, W. M., and Born, J. L., Decrease in Acetaminophen Toxicity in Mice Treated with Metyrapone. Toxicol Letters 4:379-384 (1979).
13. Born, J. L., Hadley, W. M., Anderson, S. L., and Yuhas, J. M., Host and Hypoxic Cell Toxicity Studies with the Terminal Reduction Product of Misonidazole. Presented to the Conference on Combined Modality Cancer Treatment: Radiation Sensitizers and Protectors, Key Biscayne, Florida (October 3-6, 1979).
14. Born, J. L., Hadley, W. M., Anderson, S. L., and Yuhas, J. M., Host and Hypoxic Cell Toxicity Studies with the Terminal Reduction Product of Misonidazole. Cancer Management 5:79- 83 (1980).
15. Born, J. L., and Hadley, W. M., Inhibition of In Vitro Cytochrome P-450 Reactions by Substituted Pyridines. J Pharm Sci 69:465-466 (1980).
16. Born, J. L., and Hadley, W. M., Pyridine Compounds as Type II Ligands for P-450. Presented at the Western Pharmacology Society Meeting, Vancouver (January, 1980).
17. Born, J. L., and Hadley, W. M., Ligand Interactions of 4- Pyridylethers with Cytochrome P-450. Proceedings of the Western Pharmacology Society 23:259-262 (1980).
18. Rail, C. D., Kidd, D., and Hadley, W. M., Determination of Selenium in Tissues, Serum and Blood of Wild Rodents by Graphite Furnace Atomic Absorption Spectrometry. Intern J Environ Anal Chem 8:79-87 (1980).
19. Kelly, H. W., Murphy, S., and Hadley, W. M., Lack of Correlation Between Serum and Saliva Theophylline Levels in Asthmatic Children. Am J Dis Child 135:137-139 (1981).
20. Franz, D. A., and Hadley, W. M., Lead in Albuquerque Street Dirt: Effect of Curb Paint. Bull Environ Contam Toxicol 27:353-358 (1981).
21. Hadley, W. M., and Dahl, A. R., Cytochrome P-450-Dependent Monooxygenase Activity in Rat Nasal Epithelial Membranes. Toxicol Letters 10:417-422 (1982).

22. Dahl, A. R., Hadley, W. M., Hahn, F. F., Benson, J. M., McClellan, R. O., Association of Cytochrome P-450-Dependent Monooxygenases with Olfactory Epithelium in Dogs: Possible Role in Tumorigenicity of Inhaled Materials. Science 216 57-59 (1982).
23. Hadley, W. M., Dahl, A. R., Benson, J. M., Hahn, F. F., and McClellan, R. O., Cytochrome P-450-Dependent Monooxygenases in Nasal Epithelial Membranes: Effect of Phenobarbital and Benzo(a)pyrene. Proc Western Pharmacol Soc 25:197-199 (1982).
24. Clark, C. R., Li, A. P., Henderson, T. R., Hanson, R. L., and Hadley, W. M., Role of Nitroreductase Enzymes in the Mutagenicity of Particulate Air Pollutants. Lovelace Inhalation Toxicology Laboratory Annual Report, 1980-1981, pp. 255-259.
25. Dahl, A. R., and Hadley, W. M., Cytochrome P-450 Monooxygenases in the Nose of Several Species. Lovelace Inhalation Toxicology Laboratory Annual Report, 1980-81, pp. 500-503.
26. Hadley, W. M., Dahl, A. R., Benson, J. M., Hahn, F. F., and McClellan, R.O., Cytochrome P-450 Dependent Monooxygenases in Nasal Epithelial Membranes: Effect of Phenobarbital and Benzo(a)pyrene. Presented at the Western Pharmacology Society meeting, Santa Fe (January 12, 1982).
27. Dahl, A. R., and Hadley, W. M., Biotransformation Enzymes (Cytochrome P- 450-Dependent Monooxygenases) in the Nasal Epithelial Membranes and Turbinates of Several Species. Presented at the Society of Toxicology meeting, Boston, Mass. (February 23, 1982).
28. Clark, C. R., Brooks, A. L., Li, A. P., Hadley, W. M., Han son, R. L., and McClellan, R. O., Mutagenicity of Fossil Fuel Combustion Products in Standard and Nitroreductase-Deficient Salmonella typhimurium. Presented at the Environmental Mutagen Society meeting, February 26, 1982, Boston, Massachusetts.
29. Kidd, D. E., and Hadley, W. M., Environmental Legacy - Kepone. American Biology Teacher 44:466-471 (1982).
30. Dahl, A. R., and Hadley, W. M., Biotransformation Enzymes in Nasal Tissues. Invited paper, Symposium on "Nasal Carcinogens: Studies on Their Mechanisms of Action", Presented at the ASPET/SOT Joint meeting, August 15-19, 1982.
31. Hadley, W. M. and Dahl, A. R., Cytochrome P-450-Dependent Monooxygenase Activity in Nasal Membranes of Six Species. Drug Metab Dispos 11:275- 276 (1983).
32. Dahl, A. R., and Hadley, W. M., Formaldehyde Production Promoted by Rat Nasal Cytochrome P-450-Dependent Monooxygenases Using Nasal Decongestants, Essences, Solvents, Air Pollutants, Nicotine and Cocaine as Substrates. Toxicol Appl Pharmacol 67:200-205 (1983).
33. Dahl, A. R., and Hadley, W. M., The Relationship Between Nasal Cancer and Formaldehyde Production by the Action of Nasal Cytochrome P-450-Dependent Monooxygenase. Third International Congress of Toxicology, August 28 - September 3, 1983, San Diego, California. Abstract in special edition of Toxicol Letters (1983).

34. Hadley, W. M., A Review of the Literature on Enzymatic Reduction of Nitrocompounds. Lovelace Biomedical and Environmental Research Institute Report, LMF 104 UC 48 (1984).
35. Born, J. L., and Hadley, W. M., Comparative Distribution of Misonidazole and Its Amine Metabolite in Female Swiss Webster Mice. Int J Rad Oncol Biol Phys 11:1157-1161 (1985).
36. Hadley, W. M., Burchiel, S. W., McDowell, T. D., Thilsted, J. P., Hibbs, C. M., Whorton, J. A., Day, P. W., and Stoll, R. E., Five Month Oral(Diet) Toxicity/Infectivity Study of Bacillus thuringiensis in Sheep. Presentation at the Society of Toxicology Annual Meeting, March 1985.
37. Burchiel, S. W., Hadley, W. M., Cameron, C. L., Fincher, R. H., Lim, T. W., and Stewart, C. C., Lead- and Cadmium-induced Alterations in Murine Bone Marrow Detected Using Multiparameter Flow Cytometry. Presentation at the Society of Toxicology Annual Meeting, March 1985.
38. Burchiel, S.W., Fincher, R.F., Lim, T-W., Hadley, W.M. and Stewart, C.C., Analysis of Heavy Metal Immunotoxicity by Multiparameter Flow Cytometry: Lead- and Cadmium-induced Cellular Alterations in Bone Marrow Obtained from Young Adult and Aged Female BALB/C Mice. Annual Meeting of the Mountain West Chapter, Society of Toxicology, Albuquerque, NM, October, 1985.
39. Burchiel, S.W., Hadley, W.M., Cameron, C.L., Fincher, R.F., Lim, T-W., Elias, L., and Stewart, C.C., Analysis of Lead and Cadmium Immunotoxicity by Multiparameter Flow Cytometry: Kinetic Correlation of Flow Cytometry and Immune Function Data in B6C3F1 Mice. Third Annual Meeting of the Mountain West Chapter, Society of Toxicology, Albuquerque, NM, October, 1985.
40. Burchiel, S.W., Barton, S.L., Fincher, R.F., Lim, T-W., Hadley, W.M., Stewart, C.C. and Dean, J.H., Comparison of Multiparameter Flow Cytometry and Functional Tests for the Assessment of 7,12-Dimethylbenzanthracene (DMBA) Immunotoxicity in B6C3F1 Mice. Third Annual Meeting of the Mountain West Chapter, Society of Toxicology, Albuquerque, NM, October, 1985.
41. Burchiel, S.W., Barton, S.L., Fincher, R.F., T-W Lim, Hadley, W.M., and Dean, J.H., Comparison of Multiparameter Flow Cytometry and Functional Tests for the Assessment of 7,12- Dimethylbenz(a)anthracene (DMBA) Immunotoxicity in B6C3F1 Mice. Poster, March 1986 Society of Toxicology Meeting, New Orleans, Louisiana.
42. Born, J. L., Hadley, W. M., and Desmond, M., Evidence for Regiospecificity in the Microsomal Oxidation of Nifedipine. Presented at the Forth Annual Meeting of the Mountain West Chapter of the Society of Toxicology, October 2-3, 1986, Tucson, AZ.
43. Born, J. L. and Hadley, W. M., Evidence for Regiospecificity in the Microsomal Oxidation of Nifedipine. Presentation, 1987 Society of Toxicology Annual Meeting, Washington, D.C., (Abst.) Toxicologist 7:7, 1987.
44. Burchiel, S. W., Fincher, R. F., and Hadley, W. M., Inhibition of Induction of IL-2 Receptor Expression by DMBA Detected Using Flow Cytometry. Presentation, 1987 Society of Toxicology Annual Meeting, Washington, D. C., (Abst.) Toxicologist 7 26, 1987.

45. Hadley, W. M., Burchiel, S. W., McDowell, T. D., Thilsted, J. P., Hibbs, C. M., Whorton, J. A., Day, P. W., Friedman, M. and Stoll, R. E., Five Month Oral(Diet) Toxicity/Infectivity Study of Bacillus thuringiensis. Fund. Appl. Toxicol. 8:236-242 (1987).
46. Burchiel, S. W., Hadley, W. M., Cameron, C. L., Fincher, R. H., Lim, T. W., and Stewart, C. C., Flow Cytometry Coulter Volume Analysis of Lead- and Cadmium-Induced Cellular Alterations in Bone Marrow Obtained from Young Adult and Aged Balb/c Mice. Tox. Letters 34:89-94 (1987).
47. Burchiel, S. W., Hadley, W. M., Cameron, C. L., Fincher, R. H., Lim, T- W., Elias, L., and Stewart, C. C., Analysis of Cadmium and Lead Immunotoxicity by Multiparameter Flow Cytometry: Correlation of Flow Cytometry and Immune Function Data in B6C3F1 Mice. Int. J. Immunopharmacol. 9:597- 610 (1987).
48. McDowell, T. D., Reed, K. and Hadley, W. M., ppGpp Accumulation During Amino Acid Starvation in Three Streptococci. Poster, 1987 Amer. Soc. Microbiol. Annual Meeting, Atlanta, Ga.
49. McDowell, T. D., Reed, K. E., and Hadley, W. M., Accumulation of ppGpp in Three Streptococci During Periods of Amino Acid Starvation. FEMS Microbiology Letters 56, 151-156 (1988).
50. Born, J. L. and Hadley, W. M., Isotopic Sensitivity in the Microsomal Oxidation of the Dihydropyridine Calcium Entry Blocker Nifedipine. Microsomal Oxidation of Nifedipine. Chemical Research in Toxicology 2, 57-59 (1989).
51. Dahl, A. R. and Hadley, W. M., Nasal Cavity Xenobiotic Metabolism: Effects on the Toxicity of Inhalants. Critical Reviews in Toxicology, 21, 345-372 (1991).
52. Hadley, W. M., "Basic Principles of Hazardous Waste Toxicology", in Regulatory Requirements for Hazardous Materials, Somendu B. Majumdar (Ed.), McGraw-Hill, Inc., 1993, pp. 75-98.
53. Coauthored Life Sciences Section of, Requirements for Space-Based Scientific Research Using a Spaceport, prepared by the Scientific Advisory Committee for the Southwest Regional Spaceport Program, Jack O. Burns, Chair, Physical Sciences Laboratory, New Mexico State University, Las Cruces, NM 88003-0002, PSL-93/70 (1993). pp. 65-85.

OTHER PRESENTATIONS

"Credentialing – Lesions from the Past and Future Directions", Western States Pharmacy Conference, Tucson, April 2000.

"Environmental Toxicology: May We Live in Interesting Times." Southwestern Association of Toxicologists, Santa Fe, November 3, 1995.

"Pharmacy as a career and what are drugs?" Pinyon Camp, Tijeras, NM, March 10, 1994, April 25, 1994.

Panel participant, Environmental Experts Meeting, NET-WERC, February 2,3, 1994

"From Weeds and Seeds to Molecular Biology, the History of Drug Development in New Mexico", Friends of the Rio Grande Botanic Garden, Inc., Albuquerque, NM, November 7, 1993.

"The UNM College of Pharmacy", Shrine Caravan Club, July 19, 1993.

"Drugs from Natural Sources", Pinyon Camp, Tijeras, NM, May 10, 1993.

"The UNM College of Pharmacy", Albuquerque Host Lions Club, April 20, 1993.

Program Leader, Waste Education Research Consortium Environmental Risk Management Video Conference Series, "How do we decide what is risky? Technical and Social Methods for Identifying Risk." Aired live on March 10, 1993, available on videotape.

Comoderator with Tris McSherry: "Potpourri I", Western States Pharmacy Conference, Santa Fe, NM, February 20, 1993.

"From Weeds and Seeds to Molecular Biology: The History of Pharmacy in New Mexico", copresenter with Robert Ghattas and Leo Gomez, SACNAS Annual Meeting, January 1993, Albuquerque.

"Toxicology in New Mexico and the Rocky Mountain Region", New Mexico Hazardous Waste Society, December 1992.

Facilitator, Continuing development of Mission, Goals, and Objectives for the New Mexico Pharmaceutical Association, November 1992.

Facilitator, Development of Mission, Goals, and Objectives for the New Mexico Pharmaceutical Association, December 2, 1990.

"Basic Principles of Handling of Foreign Chemicals by the Body", NMERI Occupational Health and Safety Bureau Training Program, June 1989.

"Toxicity of PCBs and By-products/Contaminants", Albuquerque Environ mental Health Conference on PCBs, August 26, 1987.

"College of Pharmacy Update", New Mexico Pharmaceutical Association Convention", May 1987, Albuquerque.

"The Potential Health Effects of Pesticides in Ground Water", New Mexico EID, May 1987, Santa Fe.

"The Environmental Toxicology of Polychlorinated Biphenyls, Dioxins and Furans." Invited presentation to the annual meeting of the Rio Grande chapter of the American Association of Industrial Hygienists, Santa Fe, New Mexico, December 1985.

"Water Pollution and Cancer." Panel Discussion on Water Quality and Water Pollution in New Mexico, Socorro, April, 1984.

"Cytochrome P-450 Isozymes." Lovelace Inhalation Toxicology Research Institute, July, 1983.

"TCDD." Board of the Bernalillo County Cancer Society, May, 1983.
"Metabolism of Nitroaromatic Compounds." Lovelace Inhalation Toxicology Research Institute, Cell Toxicology Group Seminar, Albuquerque, October 20, 1981.

"The Toxic Substances Control Act." Lovelace Inhalation Toxicology Research Institute, Toxicology Group Seminar, Albuquerque, August, 1981.

"Principles of Toxicology." NIOSH Symposium for Industrial Nurses, Albuquerque, May, 1981.

"Effects of Old Age on Drug Action." Student Scholarship Fund Continuing Education Program, November, 1980.

"Drug-Diet Interactions." College of Pharmacy Continuing Education Presentation, October 7, 1979.

"Toxicology and Drug Interactions." New Mexico State Penitentiary, September 26, 1978.

"Drug Metabolism." Thrifty Pharmacists, Albuquerque, September 24, 1978.

"Solvent Abuse." New Mexico Health Education Coalition, Albuquerque, April 21, 1978.

"Drug Metabolism in Geriatric Patients." New Mexico Continuing Education Program for Nursing-Pharmacy, College of Santa Fe, February 17, 1978.

"Drug Abuse." New Mexico State Police Academy, Santa Fe, February 14, 1978.

"Drug-Food Interactions." Maternal and Infant Nutrition Program, Albuquerque, March 2, 1977.

"Drug Metabolism." New Mexico State Nurses' Association, Albuquerque, September 10, 1976.

"Drug-Food Interactions." Albuquerque Dietetics Association, Albuquerque, May 10, 1976.

"Environmental Pollution and Health." Redeemer Lutheran Church, Albuquerque, September 14, 1975.

"Drug Abuse." SERTOMA Club, Albuquerque, May 15, 1975.

"Smoking and Health." Sunport Optimists' Club, Albuquerque, April 30, 1975.
"Drug Abuse." Griegos Elementary School, Albuquerque, March 7, 1974.

"Air and Water Pollution." La Mesa Elementary School, Albuquerque, December 5, 1973.

"Toxicology Aspects of Drug Abuse." Tri Beta Biology Club, New Mexico Institute of Mining Technology, Socorro, April 26, 1973.

"Toxicology and the Pharmacist." New Mexico State Pharmaceutical Association Meetings, Fall, 1972.

GRANTS AND PROPOSALS

NIH (Minority Biomedical Advancement Program), "Cadmium and Drug Metabolism". September, 1974 to September, 1977, $38,500.

NIH (Minority Biomedical Advancement Program), "Cadmium and Drug Metabolism. August 20, 1977 to August 19, 1980, $48,786.

American Cancer Society, "Investigation of the Mechanism of Metyrapone Induction of Synchronous Cell Cycle in Multicellular Tumor Spheroids". November 1, 1978. Approved but not funded.

NIH, "Metabolism and Toxicity Studies of Misonidazole". Co-principal Investigator with J. L. Born. Submitted July 1, 1979. Approved but not funded.

University of New Mexico Research Allocations Committee, "Isolation and Purification of Cytochrome P-450 Isozymes from Rabbit Nasal Membranes". $2000, March to July, 1983.

Sandoz Inc., "A Five Month Oral (Diet) Toxicity/Infectivity Study on Bacillus thuringiensis in Sheep". Co-investigator, $125,000, September, 1983 to September, 1984.

NIH (Minority Biomedical Advancement Program), "Characterization of Rat Nasal Cytochrome P-450 Isozymes using Selective Inhibitors". 38,000, January 1, 1984 to December 31, 1987.

NIH, "Multiparameter Analysis of Immunotoxicity by Flow Cytometry". Co-investigator. $165,352, July 1, 1984 to June 30, 1987.

NIH, "Analysis of Dioxin Immunotoxicity by Multiparameter Flow Cytometry". Co-investigator. $309,593, Approved but not funded.

NIH, "Metabolite Involvement in Radiosensitizer Neurotoxicity". Co-investigator. $63,000, Approved but not funded.

NIA, "Comparison of the Immunotoxic Effects of Lead and Cadmium in Young Adult and Aged B6C3F1 Mice Using Flow Cytometry", September 1, 1985 until March 1986. Provided mice for pilot study.

NIH, "Analysis of Immunotoxicity by Multiparameter Flow Cytometry", $322,628, July 1, 1986 to June 30, 1989. S.W. Burchiel Principal Investigator, Co-investigator 10% time. Approved but not funded.

DOE, "Community-Based Risk Assessment & Risk Management to Support the DOE Environmental Management Program "Proposal development committee. Participant. Submitted June 1994, not funded.

Department of Veterans Affairs, "Good Clinical Practices Monitoring Program", October 1, 1995 – September 30, 1996, $289,839

Department of Veterans Affairs, "Good Clinical Practices Monitoring Program", October 1, 1996 - September 30, 1997, $292,858

Department of Veterans Affairs, "Good Clinical Practices Monitoring Program", October 1, 1997 - September 30, 1998, $280,732

Department of Veterans Affairs, "Good Clinical Practices Monitoring Program", October 1, 1998 – September 30, 1999, $267,217

Department of Veterans Affairs, "Good Clinical Practices Monitoring Program", October 1, 1999 – September 30, 2000, $270,129

Department of Veterans Affairs, "Good Clinical Practices Monitoring Program", October 1, 2000 – September 30, 2001, $293,900

OTHER ADMINISTRATIVE EXPERIENCE

COLLEGE OF PHARMACY

Library Committee, 1973 - 1986.
Admissions Committee, 1973 - 1985.
Continuing Education Committee, 1973 - 1981.
Curriculum Committee, 1973 - 1981 (Chairman, 1979 - 1981).
Research and Service Allocations and Policy Committee (Chairman, 1977 - 1986).
Tenure and Promotion Committee (Chairman 83 - 84)
Graduate Committee (Chairman, 84)
Numerous Pharmacy faculty search committees as member and chair.
Faculty advisor to the Student American Pharmaceutical Association Chapter, 1975 - 1977.
Faculty advisor to Kappa Psi Pharmaceutical Fraternity, 1975.
Academic advisor to many pharmacy students 1972-86

UNIVERSITY OF NEW MEXICO

Human Uses Subcommittee of the Radiation Control Committee, 1974 to 1986.
Radiation Protection Subcommittee of the Radiation Control Committee, 1974 to 1986.
Committee on the Use and Care of Laboratory Animals, 1975 to 1986. Chairman of the Subcommittee on Chairman and Membership, 1985.
Faculty Policy Committee, 1975.
Faculty Senate (College of Pharmacy Representative), 1976 -1978, 1982 - 1984.
Faculty Senate (Senator-at-Large), 1978 - 1980.
Faculty Senate Executive Committee, 1978 - 1980.
Faculty Senate Operations Committee, 1979 - 1980.
Faculty Senate Vice-President, 1979 - 1980.
Ad Hoc Committee on Graduate-Professional Education, 1976.
Faculty Senate Committee on Student Affairs and Extracurricular Activities, 1976 - 1979 (Chairman, 1978 - 1979).
President's Task Force on UNM/TVI Immediate Cooperative Academic Planning, 1978 - 1979.
President's Committee for Development of a New University Student Grievance Policy, 1979 - 1980.
Provost's Committee on the University Living/Learning Environment. Chairman of the Subcommittee on Student-Faculty Relations, 1979 - 1980.
Hazardous Materials Program Task Force, University of New Mexico-Los Alamos, 1981.
Long Range Planning Committee, 1983 to 1986
Budget Review Committee, 1983 - 1985.
Senate Graduate Committee, 1984 - 1985

Bachelor of University Studies Faculty Advisory Committee, 1983 - 1984.
President's Strategic Planning Committee, 1985 - 1987. Chair, Academic Subcommittee on Law, Anderson School of Management, Public Administration, and IARS. Member of the Academic Subcommittee on Biology, Chemistry, Geology, Psychology and Mathematics
President's Advisory Council, 1986
Search Committee, Vice President for Academic Affairs, 1986.
Search Committee (Chairman), Dean of the Anderson Schools of Management, 1986-87.
Steering Committee, University United Way Campaign 1987
Ad Hoc Evaluation Committee, Dean of Continuing Education 1988
Dean's Caucus 1987 - 1989
Ad Hoc Evaluation Committee, Director of Dental Programs, Chairman 1989
U.S. Department of Energy Waste Education Research Consortium UNM Executive Committee, 1989 -1992
Planning Counil, 1994-, Chair, Tuition and Enrollment Management Subcommitee 1994-96
President's Council, 1994-1997
Health Sciences Center Leadership Council 1994 - 2002
University Hospital CEO search committee 1997
Lovelace Respiratory Research Institute/UNM Health Sciences Center Affiliation Agreement Committee 1997 – 1999
UNM Plan to Plan Committee 1999
NIEHS P20 Developmental Center Internal Advisory Board 1999 - 2002
Student Systems Steering Committee, 2001 – 2002
Provost's Urban Consortium, 2001- 2002

STATE, REGIONAL AND NATIONAL ORGANIZATIONS

Program Committee of the Biological Sciences Section of the American Association of Colleges of Pharmacy (1985).
Volwiler Award Biological Sciences Peer Review Committee of the American Association of Colleges of Pharmacy (1985).
Ad Hoc Committee on Recruitment of Pharmacy Graduates into Graduate Studies - Biological Sciences Section of the American Association of College of Pharmacy (1985).
Member, United States Pharmacopeial Convention 1986 - 2002
Member, Mountain West Society of Toxicology Council, 1988 -1992
New Mexico State University, U.S. Department of Energy Waste Management Education Research Consortium Affiliates Advisory Committee, 1990 – 2002, Steering Committee, 1992
National Center for Toxicology Research Associated Universities Nomination Committee, Chairman, 1990.
Associated Universities for Toxicology Research and Education Board of Directors 1990 – 1992

Chairperson, Platform Session, 1990 Mountain West Society of Toxicology Meeting.
Chairperson, Nasal Toxicology Poster/Discussion Session 1991 Society of Toxicology Annual Meeting.
Member, Search Committee for Director of the WERC Carlsbad Environmental Monitoring Laboratory, 1991.
Member, American Association of Colleges of Pharmacy Academic Affairs Committee, 1991-1992
Member, Scientific Advisory Board, WERC Carlsbad Environmental Monitoring and Research Laboratory, 1992-1997
Member, Southwest Regional Space Port Scientific Advisory Committee, 92-93
Member, Advisory Board, Risk Assessment Videoconference series, 1992
Member, Advisory Board, Mixed Waste Videoconference series, 1993
Member, American Association of Colleges of Pharmacy Council of Deans Resolutions Committee, 92-93.
Chairman, American Association of Colleges of Pharmacy Council of Deans Resolutions Committee, 93-94.
Member, Albuquerque TVI Pharmacy Technician Program Advisory Board, 1993 - date
Member, New Mexico Pharmaceutical Association Pharmacist Clinician Regulation Development Committee, 1994.
Member, Board of Examiners, New Mexico Pharmaceutical Association Technician Certification Program, 1993-1995.
Member, New Mexico Pharmaceutical Association Executive Council, 1994 - 2002
Member, American Association of Colleges of Pharmacy Council of Deans Nominations Committee, 1994
Member, Board of Directors, TC International Corporation, 1994 – date.
Chair, Nominations Committee, Section of Biological Sciences, American Association of Colleges of Pharmacy, 1997.
Member. Nominations Committee, Section of Biological Sciences, American Association of Colleges of Pharmacy, 1998
Member, Ad hoc WERC program review committee, New Mexico State University, 1998
Member USP Constitution and Bylaws Committee, 1999 – 2000
Member, Advisory Committee to the Director, National Center for Environmental Health, Centers for Disease Control and Prevention, 2002 - date

CONSULTATIONS

Consultant to Richard Ransom, lawyer for the Huckleby Organic Mercurial Poisoning Case (1976)
NIH Ad Hoc Consultant on a site visit to Tuskegee Institute (1977)
Consultant on a Teflon fume fever poisoning case (1977)
Consultant to Anaconda Corporation on a TDS water pollution problem (1979)

Consultant to the law firm of Knight and Sulivan on a herbicide poisoning case (1979).
Consultant to the New Mexico Poison Control and Drug Information Center 1975-
NIH Proposal Review Panel for the MBRS Program (September 1983)
NIH site visit to Alcorn State University (January, 1984)
NIH Proposal Review Panel for the MBRS Program (March, 1984).
Consultant to Carpenter Law Office, Ltd. on a wide variety of cases. 1983 -1993
NIH Proposal Review Panel for the MBRS Program (December, 1984)
Member, Governor's Polychlorinated Biphenyl Expert Advisory Panel (1985 - 1986)

MEETINGS ATTENDED

FASEB Meeting, 71, 72, 76
Society of Toxicology Meeting 72-75, 77-79, 82, 85-90, 92-93, 96, 98,99
Meeting of the Southwestern Association of Toxicologists 79, 90, 95
Western Pharmacology Society Meeting 82, 90
American Association of Colleges of Pharmacy 85-87, 88-01
Mountain West Chapter of the Society of Toxicology 85, 87, 88, 90-92, 94
American Association of Colleges of Pharmacy Interim Council of Deans Meeting 87-02
American Pharmaceutical Association, 99 - 01
U.S.P. Quinquennial Meeting, 90, 95, 00
1990 Managing Change, Walgreens Deans Seminar
1998 Walgreens Deans Seminar
1990 WERC/Sandia Corporation Symposium
New Mexico Pharmaceutical Association Annual Meeting, 91- 00
District Meeting, NABP/AACP, 92, 94, 95, 00
1993 Society for the Advancement of Chicanos and Native Americans in Science Annual Meeting, Albuquerque, NM
1993 The second annual "Ask the Environmental Experts Workshop, " Waste Minimization and Pollution Prevention", January 27-29, 1993.
1993 Western States Pharmacy Conference, 93, 00
1994 Environmental Experts Meeting, Albuquerque, February 2,3, 1994
WERC Advisory Board and Design Contest, April 13, 14, 1994, Las Cruces
1994 New Mexico Conference on the Environment, April 25, 26, 1994, Albuquerque
1997 New Mexico Space Port Summit, Aug. 14, 1997, Las Cruces, NM
National Association of Chain Drug Stores Annual Meeting, 01

WORKSHOP PRESENTED

"Toxic Substances in the Environment", NSF/AAAS Chautauqua Program. Miami University, October 29-30, 1979, February 18-19, 1980; University of Hartford,

October 25-26, 1979, February 25-26, 1980, Pennsylvania State University, October 22-23, 1979, February 21-22, 1980; University of Georgia, November 1-2, 1979, February 28-29, 1980.

"Toxic Substances in the Environment", NSF/AAAS Chautauqua Program. Oregon Graduate Center, November 18-20, 1982; Plains College, March 10-12, 1983.

Lead presenter with Lynn Anspaugh, WERC Teleconference Series, Environmental RISK Management Videoconference Series, How Do We Decide What Is Risky? Technical and Social Methods for Identifying Risk. Broadcast March, 10, 1993. Available on videotape.

GRADUATE STUDENTS

Major Advisor for 3 Ph.D. graduates and 7 M.S. graduates.

Representative John Heaton is a state representative serving his forth term representing the people of southeastern Eddy County, New Mexico. He received a BS in pharmacy from the University of New Mexico and subsequently became a Fellow in the American Society of Consultant Pharmacists. He practiced primarily in southern New Mexico where he owned and operated several pharmacies as well as a number of other allied health businesses. He has served on many community boards and he has received virtually all of the state's pharmacist awards as well as the national Bowl of Hygea award.

Dr. Craig Marcus is currently Professor of Toxicology, Chair of the Division of Pharmaceutical Sciences, and Vice-Dean at the College of Pharmacy at the University of New Mexico. He earned a B.S. in Biochemistry (1975), M.S. in Entomology/Toxicology (1978), and Ph.D. in Entomology/Toxicology (1981) from the University of Wisconsin-Madison. Dr. Marcus is an expert in the structure, function and expression of the cytochromes P450 super family of enzymes and his laboratory studies these proteins with a current focus their roles in environmental disease and cancer.

Michael H. Reynolds

Michael H. Reynolds is the chief of the Carlsbad Fire Department which has the mission to provide with excellence and compassion to the citizens of Carlsbad fire and emergency medical services of the highest quality. He has been a member of the Carlsbad Fire Department for over 13 years. He is a certified Hazardous Materials Technician with a specialty in chemistry. His teaching experience includes but is not limited to (a) Chemistry of Hazardous Materials, (b) Hazardous Materials Transportation Regulations (49CFR100-185), (c) Response to Weapons of Mass Destruction, (d) Emergency Medical Treatment for Weapons of Mass Destruction, (e) Incident Command, (f) response to Mass Casualty Incidents, (g) Cave and High Angle Rope Rescue, and (h) Hazardous Materials Awareness, Operations, and Technician training courses.. He is a licensed Paramedic with 25 years experience. He has worked as a chemist for Falk Corporation in Milwaukee, WI; and as an Air Traffic Controller for the Federal Aviation Administration at the Minneapolis Air Route Traffic Control Center (MSP ARTCC).

Mr. Reynolds was born and raised in Washington, D.C. and has lived in New Mexico for 21 years. He was educated at Marquette University High School in Milwaukee, the University of Notre Dame, the University of Wisconsin at Madison, Western Illinois University, Arapaho Community College near Denver, Eastern New Mexico University at Roswell, El Paso Community College, and New Mexico State University at Carlsbad. He holds two Associate degrees, a Bachelor's degree and is beginning a Master's program in Fire and Emergency Management Administration.

Van D. Romero, Ph.D.

Education

- Ph.D., Physics, State University of New York, 1991
- M.S., Physics, New Mexico Institute of Mining and Technology, 1979
- B.S., Physics, New Mexico Institute of Mining and Technology, 1977

Current Employment

Since 1997: Vice President for Research and Economic Development, New Mexico Tech.
Serves as chief official of the Research and Economic Development Division responsible for the encouragement, leadership, and support of research at the Institute and for the administrative and policy making activities of the division; offers dynamic research and administrative leadership to stimulate, coordinate, and provide support for the research at New Mexico Tech; acts as advocate for research within the Institute; serves as director of the Geophysical Research Center; manages the research support functions of the Research Division; serves as the Institute's representative and on-campus administrator for the Waste-Management Education and Research Consortium; acts as an external advocate and representative for New Mexico Tech's research activities; serves as mentor to new faculty to help them establish their research programs at the Institute; strongly encourages diversity and affirmative action; identifies research opportunities and actively encourages development of interdisciplinary research at the institute; ensures that high quality proposals are submitted by the Institute.

Previous Experience

1995-1997: Director, Energetic Materials Research & Testing Center, New Mexico Tech.
Direct and manage a multi-disciplinary team of scientists, engineers, and staff involved in RDT&E programs in energetic materials. EMRTC provides a working laboratory for conducting research in support of both government and commercial programs in the areas of ordnance, explosives, propellants and other energetic materials. Facilities include over 30 separate test sites, gun ranges and research labs located within a 32 square mile field laboratory. Developed and implemented counter-terrorist program that benefits research and academic programs.

1994 - 1995: Senior Member Technical Staff, Sandia National Lab, Albuquerque, NM.
Conducted Environmental Impact Assessment for Medical Isotope Production program. Program consisted of converting weapons program facility to produce radio-isotopes for medical usage.

1993 - 1994: Deputy Director of Environmental, Safety and Health Oversight; Manager, Hazardous Waste Programs, Superconducting Super Collider, Dallas, TX.
Developed and implemented radiation protection policies compatible with DOE orders and CFR regulations, performed liaison activities with DOE, and provided technical direction to radiation and hazardous waste program. Responsible for the development and review of radiation transport calculations, shielding design, health physics procedures, mixed waste procedures, and environmental monitoring activities. Served as Chairman of the Laboratory's ALARA committee and member of DOE's R&D Laboratory Working Group (RADWG) Health Physics Procedures Committee. Responsible for RCRA compliance during project closure.

1979 - 1993: Manager, Thermal Hydraulic Programs, General Electric Knolls Atomic Power Lab, Schenectady, NY.
Responsible for both the technical and personnel management of the group. Key participant in the long term planning and direction of both the research and the facilities construction and maintenance. Group responsibilities included thermodynamic and materials testing and analysis of fuel channels, steam generators, and in-core materials. This work determined the thermodynamic limits for the nuclear reactor which will power the next generation submarine scheduled for delivery at the turn of the century. In previous work as Lead Engineer, was responsible for the experimental fluid mechanics effort and developed LASER instrumentation and techniques for flow visualization and quantitative flow measurements. Additional experience includes the development, execution, and analysis of environmental impact testing of nuclear sub marines which includes radiation transport analysis, neutron detection, and gamma ray spectroscopy.

Current Funded Research Activities

- Experimental verification of the alpha-omega effect for galaxy formation with Los Alamos National Laboratories.
- Develop groundwater activation model that can be used to optimize the design for acceleration production of tritium with DOE.
- Seismic source investigation, modeling and characterization of currently deployed explosive sources, design and computational testing of improved explosive sources, experimental verification and validation of improved sources - Western Geophysical (students - recruiting, post-doc and graduate in Geophysics).
- Resusable blast test fixture, investigate explosive impact on wide-body aircraft with FAA.

Courses Taught

- Graduate and undergraduate courses in Solid State Physics and Particle Physics for the Physics Department
- Course in Explosives Surety for the Chemical Engineering Department

Patents Held

- Procedure to study Bubble Evolution by correcting scattered LASER light and dynamic pressure signals

Professional Memberships

- American Physical Society
- Sigma XI
- Health Physics Society

Conference Publications (1997)

- Romero, V., P. E. Williams, D. Collis, S. Welch. "Blast Research, Development, Test and Evaluation," 2nd Asia Pacific Conference on Shock Impact Loads on Structures: Melbourne, Australia; November 25-27.
- Romero, V. and Williams, P. E "Blast Waves from Non-Ideal Explosives," Conference of the American Physics Society Topical Group on Shock Compression of Condensed Matter; Amherst, MS; July 28-August 1.
- Ferrel, R. and Romero, V. "Simulation of High Density Hydrogen Compression," Conference of the American Physical Society Topical Group on Shock Compression of Condensed Matter; Amherst, MS; July 28-August 1.
- Romero, V. Invited Presentation: "Terrorist Bombs: The Characteristic of 'Non-ideal' Explosives." American Society of Civil Engineers, Architectural Engineering Division; Mitigation of the Effects of Terrorist Violence: A Research Planning Conference; March 13-14; Newark, NJ.

Journal Publications

- "Superconducting Super Collider Laboratory Groundwater Model," *Journal of Health Physics*, November, 1997, Volume 73, No. 5 (Jeffrey S. Bull, Van D. Romero, Samuel I. Baker, Geoffrey B. Stapleton, David L. Goss, and Larry V. Coulson).
- "Blast Waves from Non-Ideal Explosives," in *Specialty Symposium on Structures Response to Impact and Blast*, Tel Aviv, Israel, October 1996 (CLEO Collaboration).
- "SPH Calculations of Impact Fracture in Steel Cubes," In *16th International Symposium on Ballistics*, September 1996 (CLEO Collaboration).
- "Environmental Radiation Monitoring Station," *Health Physics Society Annual Meeting*, June 1994 (CLEO Collaboration).
- "Radiological Survey of Surface and Tunnel Areas at the Superconducting Super Collider," *Health Physics Society Annual Meeting*, June 1994 (CLEO Collaboration).
- "Overview of Radiation Protection at the Superconducting Super Collider Laboratory," *8th International Conference on Radiation Shielding*, Apr 1994 (CLEO Collaboration).
- "Search for Exclusive b ? u Semileptonic Decays of B Mesons," *Physical Review Letters*, vol. 70, #18, 2681, 3 May 1993 (CLEO Collaboration).
- "Measurement of the ?-lepton mass," *Physical Review D Rapid Communications*, vol 47, #9, R3671, 1 May 1993 (CLEO Collaboration).
- "Production and decay of the Dsl (2536)+," *Physics Letters B* 303 (1993) 377-384, 15 Apr 1993 (CLEO Collaboration).
- "Tau Decays with One Charge Particle Plus Multiple ?0's," *Physical Review Letters*, vol 70, #9, 1207, 1 Mar 1993 (CLEO Collaboration).
- "Lepton asymmetry measurements in B??D* l- ?l and implications for V - A and the form factors," *Physical Review D*, vol 47, #3, 791, 1 Feb 1993 (CLEO Collaboration).
- "Search for ?-? ??- : A Test of Lepton Number Conversation," *Physical Review Letters*, vol 70, #2, 138, 11 Jan 1993 (CLEO Collaboration).
- "Measurement of ? Decays Involving ? Mesons,?" *Physical Review Letters*, vol 69, #23, 3278, 7 Dec 1992.
- "Exclusive ?(2P) production in Y(3S) decay," *Physics Letters B* 294 (1992) 139-144, 5 Nov 1992 (CLEO Collaboration).
- "Isospin Mass Splittings from Precision Measurements of D*-D Mass Differences," *Physical Review Letters*, vol 69, #14, 2046, 5 Oct 1992 (CLEO Collaboration).
- "A measurement of the tau lepton lifetime," *Physics Letters B* 291 (1992) 488-495, 1 Oct 1992 (CLEO Collaboration).
- "Two-body decay to ??+, ??+, ???+, and ??+," *Physical Review D*, vol 45, #11, 3976, 1 Jun 1992 (CLEO Collaboration).
- "Electronic branching ratio of the ? lepton," *Physical Review D*, vol 45, #11, 3976, 1 June 1992 (CLEO Collaboration).
- "Measurements of semileptonic branching fractions of B mesons at the Y(4S) resonance," *Physical Review D*, vol 45, #7, 2212, 1 Apr 1992 (CLEO Collaboration).
- "Ds+ Decays to ??+, ???+, and ??+," *Physical Review Letters*, vol 68, #9, 1279, 2 Mar 1992 (CLEO Collaboration).
- "Measurements of baryon production in B-meson decays," *Physical Review D*, vol 45, #3, 752, 1 Feb 1992 (CLEO Collaboration).
- "Inclusive and exclusive decays of B mesons to final states including charm and charmonium mesons," *Physical Review D*, vol 45, #1, 21, 1 Jan 1992 (CLEO Collaboration).
- "Scattered LASER Light Techniques for Investigating Subcooled Voids," ASME FED-Vol. 125, Dec 1991.
- "Measurement of the ratio B(D0-->K*?e+?e)/B(D0-->K?e+?e)." *Physical Review D*, vol 44, #11, 3394, 1 Dec 1991 (CLEO Collaboration).
- "Unusual decay modes of D0 and D+ mesons," *Physical Review D*, vol 44, #11, 3383, 1 Dec 1991 (CLEO Collaboration).
- "Measurement of the Inclusive B* Cross Section above the Y(4S)," *Physical Review Letters*, vol 67, #13, 1692, 23 Sep 1991 (CLEO Collaboration).
- "Inclusive ?(2P) Production in Y(3S) Decay," *Physical Review Letters*, vol 67, #13, 1696, 23 Sep 1991 (CLEO Collaboration).
- "Study of continuum D*+ spin alignment," *Physical Review D*, vol 44, #3, 593, 1 Aug 1991 (CLEO Collaboration).

- "Study of D0 decays into final states with a ?0 or ?," *Physical Review D*, vol 43, #9, 2836, 1 May 1991 (CLEO Collaboration).
- "Exclusive and Inclusive Semileptonic decays of B mesons to D mesons," *Physical Review D*, vol 43, #3, 651, 1 Feb 1991 (CLEO Collaboration).
- "Measurements of the ?+c Decay-Assymetry Parameter," *Physical Review Letters*, vol 65, #23, 2842, 3 Dec 1990 (CLEO Collaboration).
- "Study of K* Production in tau decay," *Physics Letters B*, vol 251, #1, 223, 8 Nov 1990 (CLEO Collaboration).
- "222Rn and Atmospheric Electric Parameters in Carlsbad Caverns," *Journal of Geophysical Research*, vol 86, #C10, 9911, 20 Oct 1981 (Marvin Wilkening and Van R. Romero).

Contact Information for Van D. Romero

Mailing Address:
Dr. Van D. Romero
R&ED Office - Brown Hall
New Mexico Tech
801 Leroy Place
Socorro, NM 87801

E-mail: vromero@admin.nmt.edu

Phone: 505-835-5646

Fax: 505-835-6934

ANIBAL L. TABOAS

P.O. BOX 8321, ARGONNE, IL 60439

anibal.taboas@ch.doe.gov (630) 252-2236

VITAE

SUMMARY

Twenty-eight years experience of increasing executive responsibility in research, energy and environmental programs, and facility operations. Demonstrated ability in formulating environmental policy, fiscal control, program execution, and the regulatory and legislative processes. Known for project completions, "out of the box" corporate thinking, good interaction with stakeholders, risk management, and for a commitment to safety, diversity, technical competence, and sound decision making.

EXPERIENCE

US Department of Energy, (1978- present), "Q" Clearance, Senior Executive Service since 1987.

Manager, Environmental Programs Group, Chicago Operations (1995 - present). Lead executive for Environmental Management and Restoration of DOE laboratories in IL, NY, NJ, ID, and IA (e.g.: Argonne, Brookhaven, Fermi, Princeton, etc), and the Center of Excellence for Risk Management. Line manager of programs for: disposition of excess weapons plutonium, research in Energy Efficiency, and for congressional mandated construction projects. Results include multi $M's in cost avoidance and reduction, schedule acceleration, and increased stakeholder/regulator support.

Manager, Argonne Area Office, Argonne, IL (1987-1995). Line manager for safe and efficient operation of Argonne National Laboratory, which included nuclear reactors, a reprocessing plant, and major experiments in basic and applied technology. Responsible for advancing strategic initiatives such as the Advanced Photon Source ($1B) – a project completed within the original scope/schedule/cost, the Integral Fast Reactor –defueling EBR-II, technology transfer, and industrial alliances. My initiatives eliminated several $M in operating costs. As Contracting Officer, I chaired the first performance based operating contract with the Univ. of Chicago. Argonne had a staff of 4100, >$500M/yr operating budget, and $2B plant value.

Senior Technical Advisor, Defense Programs (DP), Washington, DC (1982-1987). Represented the Assistant Secretary in special assignments such as in strategic planning, and in negotiation of regulatory/ legislative initiatives with the Executive Office of the President, Congress, and industry. Involved in every major transaction affecting DP. Authored regulation defining contaminant levels requiring permanent isolation, resulting in several $B savings. Assured availability of packaging and transportation systems.

Environmental Scientist/Nuclear Engineer, ID, NM, MD (1978-1982). Lead in reprocessing navy fuel, and manage National R&D Programs for Transuranic and Airborne Waste Management (i.e.: generation, processing, transportation, and disposal of plutonium contaminated materials). Executive Officer of the Energy Research Advisory Board Task Force on Major Systems Acquisitions.

Argonne National Laboratory, **Electrical Engineer** (1972-1978). Designed I&C and plant protection systems for advanced nuclear and fossil power plants. Independently verified domestic/foreign technology.

Taboas & Co., Independent Consultant, (1971-1980). Montecarlo Calculations for neutron/gamma computations, for the University of Chicago, the Atomic Energy Commission, the National Science Foundation, the International Atomic Energy Agency (IAEA), and industry.

ACADEMIC DEGREES

BS	Physics/Philosophy (Theology)	University of Dayton,	OH
MS	Physics/Biophysics	Indiana State University,	IN
- -	Independent Research	University of Michigan,	MI / Texas Christian Univ., TX
MS	Mechanical Engineering/Nuclear	Northwestern University,	IL
D.Sc., Environmental Policy (Honoris Causa)		UPAEP (Univ. of the State of Puebla)	MX
		Thesis:	*Environmental Approach to NAFTA.*

OTHER

Recipient of several forms of recognition, including: the vice-president's **Hammer Award** (2000), the Department of Energy's (**DOE's**) **Exceptional Service Medal** (2000), DOE's Hispanic Heritage **Achievement Award in Education** (1999), the **Secretary's Gold Medal** for achievements in Contract Reform (1997), the **University of Chicago Medal for Distinguished Performance** (1995), and recognition from the Medical University of South Carolina, ASME, the Assoc., of Energy Engineers, LULAC, Roosevelt University, and others. Active in Hispanic education, affirmative action, and utilization of small/disadvantaged businesses.

Distinguished Advisor to Associated Universities for Research and Astronomy (1997-2000); Past Chair, of the Environmental Engineering Division, American Society of Mechanical Engineers (ASME); Member of journal editorial boards, including ***Waste Management***, ***Environment International***, and ***Technology.*** Chair, Accident Investigation Boards; co-editor of an ASME Decontamination and Decommissioning Technology Handbook in preparation; over 40 technical publications.

Sample Editorials (In Environment International, by Elsevier Science Ltd.):

Principles of Environmental Protection Strategy, Vol. 22 (1996).

Principles of a Multimedia, Risk-Based, Market-Driven Environmental Approach, Vol. 19 (1993).

Environmental Bubble Policy, Vol. 10 (1984).

Sample Publications

§ L. Taboas**, Restoration of the Site of the First Nuclear Reactors**, Environment International, Elsevier Science Ltd., Vol. 23, No. 4, pp. 565-585 (1997).

§ A. Moghissi, K. A. Gablin, and A. L. Taboas, **Management of Waste Containing Radioactive Materials and Chemical Agents**, International Radiation Protection Organization, IRPA 7 Australia, Vol. 3 (April 1988).

§ L. Taboas, P. Hagen, and J. Claes, **Treatment of Plutonium Contaminated Materials**, Technical Report Series No. 287, International Atomic Energy Agency, (1988).

§ D. L. Ray and A. L. Taboas, **Waste Management: The Missing Link**, Proceedings of the Waste Management '83 Symposium, University of Arizona (February 1983).

§ A, L. Taboas and A. A. Moghissi, **Health Physics Considerations in Radioactive Waste Management**, Radioactive Waste Technology, The American Society of Mechanical Engineers, pp. 125-144 (1986).

CEHMM LEDA Application
Attachment 3.d.2

Resumes of key CEHMM staff:
Douglas C. Lynn, Executive Director
Gregory W. Brown, Business Manager

DOUGLAS C. LYNN
CEHMM Executive Director
505 N. Main Street, Carlsbad, New Mexico 88220
(575) 885-3700 • dclynn@cehmm.org

EDUCATION AND TRAINING

Cumulative Post Graduate Education: 30 hours
Post graduate hours in: range science, wildlife law enforcement, wildlife biology (New Mexico State University, Las Cruces, NM) • biology (Eastern New Mexico University, Portales, NM) • human health sciences (Brigham Young University, Provo, UT)

Bachelors of Science, 1977 (Sul Ross State University, Alpine, TX)

Professional Certifications: radiological air sampling (Oak Ridge Assoc. Universities, Knoxville, TN) • petroleum technician (Oilfield Training Center, Eastern New Mexico University, Portales, NM) • naturally occurring radioactive materials surveyor (National Registry of Environmental Professionals, Glenview, IL) • assessment techniques (Oak Ridge Assoc. Universities, Knoxville, TN) • RCRA waste sampling (Hanford Environmental Training, Hanford, WA) • H2S safety (Oilfield Training Center, Eastern New Mexico University, Portales, NM) • radiochemistry data quality and data validation (Nevada Technical Assoc.) • six week course in state of New Mexico and Federal realty training • State of Texas (secondary education, teaching: lifetime) • State of New Mexico (secondary education, teaching) • master banding (permittee #22478, USF&WS) • master banding, scientific collection (permittee #1961, NMDG&F)

PROFESSIONAL EXPERIENCE

Center of Excellence for Hazardous Materials Management - August 2005 to present
Executive Director and Senior Project Manager

- Initiated, developed, and currently manage the CEHMM algae/biodiesel project
- Responsible for the day-to-day operations of the Center
- Manage the Center's staff
- Develop the budget and responsible for its implementation after approval by the Board of Directors
- Responsible for developing strategic and business plans and for their implementation after approval by the Board of Directors
- Responsible for recruiting and hiring new staff in accordance with all state and federal laws and the approved CEHMM business plan; also responsible for other related personnel actions
- Responsible for leading the effort to identify and obtain new work scope and sources of funding
- Responsible for ensuring that CEHMM complies with all requirements of a 501(c)(3) corporation
- Responsible for applications, maintenance and accounting for any grants or contracts awarded or entered into by CEHMM

Westinghouse, Waste Isolation Division – September 1990 to August 2005
Senior Scientist for Ecology, Environmental Sampling and Land Management

- Principle author of the WIPP Land Management Plan
- WIPP Land Use Coordinator
    - Environmental Compliance issues
    - Oversight and administration of reclamation/environmental restoration
    - Protection of cultural resources/recreational activities

  - Wildlife management programs
  - Oversight and administration of grazing allotments and right-of-way corridors
- Administration in the review of oil and gas activities conducted within one mile of WIPP lands
  - Principal liaison between DOE/WIPP, the State of New Mexico, and the federal Bureau of Land Management
- Team leader, assessment/disposition of WIPP groundwater well bores
  - Liaison between WIPP and the New Mexico Office of the State Engineer
  - Assessment of ultrasonic logs, pipe analysis logs, natural gamma logs, and cement bond logs
- Team leader for Radiological Environmental Surveillance
  - Scheduling and oversight of sampling activities for baseline radiological appraisals: ambient air particulates, surface waters, sediments, soils, vegetation, and other biotics
- Team leader/principal investigator for the WIPP Raptor Research and Management Program
  - Contract administration
  - Compliance
  - Field biology
  - Technical reviews and assessments
  - Custodian of Master Banding permit
  - Protocol development and administration

PUBLICATIONS

- Waste Isolation Pilot Plant Annual Site Environmental Report (DOE/WIPP 95-2094), 1994
- Waste Isolation Pilot Plant, Land Management Implementation Plan (DOE/WIPP 94-026), 1994
- Waste Isolation Pilot Plant Land Management Plan (DOE/WIPP 93-004), 1996
- Waste Isolation Pilot Plant Annual Site Environmental Report, 1995
- Environmental Monitoring and Cooperative Resource Management at the Waste Isolation Pilot Plant, a session by D.C. Lynn and S.B. Jones, Waste Management 1992, Tucson, Arizona

SYNERGISTIC ACTIVITIES

- Recipient of the U.S. Department of the Interior's Land Stewardship Award for Volunteer Service Dedicated to America's Natural Resources
- Developed and implemented an ecology course curriculum for the Westinghouse/DOE School for Environmental Excellence
- Acted as advisor to the College of the Southwest in development of curriculum for Environmental Management courses
- Ten years as a director and five years as Chairman of the Board of Carlsbad Caverns/Guadalupe Mountains (National Parks) Association.
- Served as State Director for Quail Unlimited, a national conservation organization; responsible for oversight and administration of local chapters including conservation projects

GREGORY WAYNE BROWN
2031 Quail Hollow Run
Carlsbad, New Mexico 88220
(575) 302-1963

***EDUCATION*:**

Eastern New Mexico University
Portales, New Mexico
MBA - May 1998

Texas Tech University, Lubbock, Texas
BBA in Finance - 1992
Dean's List - Spring 1990

New Mexico State University, Carlsbad, New Mexico - 1985

PROFESSIONAL EXPERIENCE:

11-2005 to present
Center of Excellence for Hazardous Materials Management, Carlsbad, NM. Business Manager. Over see and responsible for all business aspects (payroll, purchasing, audits, grant compliance, etc.) and human resources duties.

11-1999 to 11-2005
Self-employed, The Motorplex, Carlsbad, NM. Used car sales.
Family owned business with annual sales of 3 million.

10-1998 to 12-2007
Northwood University, Carlsbad, NM. Adjunct faculty, instruct business classes (Economics, finance, marketing, ethics and management)

6-1992 to 3-2002
Westinghouse Electric Corporation (Waste Isolation Pilot Plant), Carlsbad, NM. The WIPP is a Department of Energy project designed as a repository for the disposal of radioactive waste in underground salt mines. The project had an annual budget of approximately $95 Million.

Project/Program Management - Participated in the following aspects of project/program management:

- budget formulation
- budget submissions
- budget validation
- budget execution
- cost control
- schedule formulation
- project plans
- contract negotiations

These activities occurred at multiple WBS levels. The budget submission includes proposed resource, scope and schedule requirements for a 10 year period and is incorporated into DOE's budget submittal that is part of the federal budget process. Responsible to:

- Assist Cost Account Managers (CAMs) in the writing of their Statements of Work (SOW).
- Assist various projects in writing project plans
- Prepare and process Contract Change Requests for the CAMs.
- Assist CAMs in the formulation of their Basis of Estimate (BOE).
- Prepared information for the DOE Mid-Year program review.

Led and assisted in several budget audit/exercises that DOE or other agencies requested to answer various budget level scenarios or document proper budget formulation and management.

Special projects:

- Generated Statement of Work, Purchase Order and led the effort that brought a 5-day training class ("Introduction to Project Management") to our site.
- Instrumental in the introduction, implementation, and training of Activity Based Management (ABM) concept at the project.
- Provide Activity Based Management analysis for internal customers.
- Participate in program management related lessons learned/process improvement work groups.
- Responsible for the initiating, planning, executing, controlling, and closing of all construction at the project. Construction at the project includes General Plant Projects (GPPs) and minor construction (any construction project under $85,000).
- Generated Statements of Work for minor construction projects.
- Monitored and maintained monthly accruals and variances for all General Plant Projects (GPPs) and construction accounts.
- Generated DOE authorization forms for initiating all GPP's.
- Prepared and issued GPP quarterly and annual reports (DOE deliverables) which outlined project start date, BAC, ETC, EAC, all variances, and project end date.
- Verified completion of work scope in accordance with plans and specifications and generated DOE authorization forms for close-out of all GPP's.
- Coordinated with Engineering, DOE, Safety, Operations, and Quality Assurance on close-out of all GPPs and minor construction projects.
- Verified monthly payment to on-site construction sub-contractor.

MILITARY EXPERIENCE:

1986 to 1992: United States Naval Reserve, Lubbock, Texas
Heavy Equipment Operator, Third Class Petty Officer.

SYNERGISTIC ACTIVITIES:

Carlsbad Rotary Club
American Historic Racing Motorcycle Association
Treasurer, Carlsbad High School Cross Country Booster Club
Carlsbad High School Track and Field Booster Club Volunteer
Board Member, Financial Security Credit Union

Center of Excellence for
Hazardous Materials Management

FINANCIAL STATEMENTS
with
REPORT OF INDEPENDENT CERTIFIED PUBLIC ACCOUNTANTS

Years Ended September 30, 2010 and 2009

JOHNSON, MILLER & CO.
Certified Public Accountants
A Professional Corporation

An Independent Member of BDO Seidman Alliance

Center of Excellence for
Hazardous Materials Management

FINANCIAL STATEMENTS
with
REPORT OF INDEPENDENT CERTIFIED PUBLIC ACCOUNTANTS

Years Ended September 30, 2010 and 2009

CONTENTS

JOHNSON, MILLER & CO.
Certified Public Accountants
A Professional Corporation
An Independent Member Of BDO Seidman Alliance

Hobbs, New Mexico
Midland, Texas
Odessa, Texas

INDEPENDENT AUDITORS' REPORT

To the Board of Directors
Center of Excellence for Hazardous Materials Management
Carlsbad, New Mexico

We have audited the accompanying statements of financial position of the Center of Excellence for Hazardous Materials Management (a nonprofit organization) as of September 30, 2010 and 2009, and the related statements of activities and cash flows for the years then ended. These financial statements are the responsibility of the Center of Excellence for Hazardous Materials Management's management. Our responsibility is to express an opinion on these financial statements based on our audits.

We conducted our audits in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of the Center of Excellence for Hazardous Materials Management as of September 30, 2010 and 2009 and the respective changes in net assets and it's cash flows for the years then ended in conformity with accounting principles generally accepted in the United States of America.

In accordance with *Government Auditing Standards*, we have also issued our report dated January 15, 2011 on our consideration of the Center of Excellence for Hazardous Materials Management's internal control over financial reporting and on our tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements and other matters. The purpose of that report is to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing, and not to provide an opinion on internal control over financial reporting or on compliance. That report is an integral part of an audit performed in accordance with *Government Auditing Standards* and should be considered in assessing the results of our audit.

225 East Bender Blvd. • P. O. Drawer 220 • Hobbs, New Mexico 88241
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Our audit was conducted for the purpose of forming an opinion on the basic financial statements of the Center of Excellence for Hazardous Materials Management taken as a whole. The accompanying Schedule of Expenditures of Federal Awards is presented for purposes of additional analysis, as required by the U.S. Office of Management and Budget Circular A-133, *Audits of States, Local Governments, and Non-Profit Organizations*, and is not a required part of the financial statements. Such information has been subjected to the auditing procedures applied in the audit of the basic financial statements and, in our opinion, is fairly stated in all material respects in relation to the basic financial statements taken as a whole.

Johnson, Miller & Co.

Hobbs, New Mexico
January 15, 2011

Center of Excellence for Hazardous Materials Management
Statements of Financial Position
September 30,

	2010	2009
ASSETS		
Current assets		
Cash and cash equivalents	$ 2,213,486	$ 392,959
Grant receivable	500	87,211
Prepaid expenses and other current assets	17,539	15,859
Unbilled revenue	476	18,279
Total current assets	2,232,001	514,308
Property and equipment, net (Note B)	958,424	590,368
Total assets	$ 3,190,425	$ 1,104,676
LIABILITIES AND NET ASSETS		
Current liabilities		
Accounts payable	$ 99,124	$ 47,940
Accrued liabilities	111,353	105,988
Total current liabilities	210,477	153,928
Net assets		
Unrestricted	852,588	896,465
Temporarily restricted (Note C)	2,127,360	54,283
Total net assets	2,979,948	950,748
Total liabilities and net assets	$ 3,190,425	$ 1,104,676

The accompanying notes are an integral part of these financial statements.

Center of Excellence for Hazardous Materials Management
Statements of Activities
For the years ended September 30,

	2010	2009
Unrestricted net assets		
Unrestricted revenues and gains		
Grant revenue	$ 1,463,039	$ 2,688,625
In-kind revenue	48,000	42,533
Consulting income	13,185	36,498
Administrative income	17,426	1,908
Interest income	1,002	405
Other income	8,370	2,561
Total unrestricted revenues and gains	1,551,022	2,772,530
Net assets released from restrictions		
Restricted satisfied by payments	1,185,148	51,925
Total unrestricted revenues, gains and other support	2,736,170	2,824,455
Expenses		
Salaries	1,365,906	1,467,150
Consulting	404,619	340,515
Benefits	275,189	245,702
Supplies	154,759	87,814
Rent	126,898	121,961
Depreciation	118,934	86,546
Payroll taxes	99,712	110,526
Travel and training	52,636	43,963
Professional services	36,059	32,000
Insurance	28,642	18,181
Repairs and maintenance	28,892	47,579
Other general and administrative	24,833	22,792
Utilities	16,070	13,264
Other operating and maintenance	17,345	8,916
Small equipment purchases	11,933	30,498
Telephone	9,909	11,086
Loss on sale of assets	8,651	-
Total expenses	2,780,047	2,686,501
(Decrease) increase in unrestricted net assets	(43,877)	135,954
Temporarily restricted net assets		
Contributions	557,715	57,250
Supplemental Environmental Project payments	2,700,000	-
Interest income	510	517
Net assets released from restrictions		
Restrictions satisfied by payments	(1,185,148)	(51,925)
Increase in temporarily restricted net assets	2,073,077	5,842
Increase in net assets	2,029,200	141,796
Net assets at beginning of period	950,748	808,952
Net assets at end of period	$ 2,979,948	$ 950,748

The accompanying notes are an integral part of these financial statements.

Center of Excellence for Hazardous Materials Management
Statements of Cash Flows
For the years ended September 30,

	2010	2009
Resources provided		
Increase in net assets	$ 2,029,200	$ 141,796
Adjustments to reconcile increase in net assets		
to net cash provided by operating activities:		
Depreciation	118,994	86,546
Loss on sale of assets	8,651	-
Change in:		
Grant receivable	86,710	210,807
Prepaid expenses	(1,680)	4,042
Unbilled revenue	17,803	(18,279)
Accounts payable	51,184	(42,463)
Accrued liabilities	5,365	11,220
Refundable advances	-	(70,038)
Net cash provided by operating activities	2,316,227	323,531
Investing activities:		
Purchase of fixed assets	(506,700)	(216,222)
Proceeds from sale of assets	11,000	-
Net cash (used) by investing activities	(495,700)	(216,222)
Financing activities:		
Payment on capital lease	-	(9,180)
Net cash (used) by financing activities	-	(9,180)
Net increase in cash	1,820,527	98,229
Cash at beginning of period	392,959	294,730
Cash at end of period	$ 2,213,486	$ 392,959

The accompanying notes are an integral part of these financial statements

NOTES TO THE FINANCIAL STATEMENTS

NOTE A Summary of Significant Accounting Policies

This summary of significant accounting policies of the Center of Excellence for Hazardous Materials Management (Organization) is presented to assist in the understanding of the Organization's financial statements. The financial statements and notes are the representation of the Organization's management who is responsible for their integrity and objectivity. The financial statements of the Organization have been prepared in conformity with accounting principles generally accepted in the United States of America (GAAP) as applied to non-profit entities. The Financial Accounting Standards Board (FASB) is the accepted standard-setting body for establishing accounting and financial reporting principles. The more significant of the Organization's accounting principles are described below.

1. *Nature of Business*

The Center of Excellence for Hazardous Materials Management is dedicated to applied research in areas of study that benefit the environment, help to create jobs in clean, new industries, and preserve human health. The Organization has a nationally recognized research and development project in growing, harvesting, and extracting oil from algae with the goal of producing transportation fuel and using the algae biomass for co-products. A wildlife conservation project focused on the preservation of two threatened species, the lesser prairie chicken and the sand dune lizard, is also part of the Organization's portfolio of projects. This conservation project has been recognized by the federal government and the state of New Mexico as an innovative model for the preservation of species.

2. *Basis of Accounting*

The financial statements of Center of Excellence for Hazardous Materials Management have been prepared on the accrual basis of accounting, and accordingly reflect all significant receivables, prepaids, payables, accruals, and other liabilities.

3. *Basis of Presentation*

Financial statement presentation follows the recommendations of the Financial Accounting Standards Board (FASB) Accounting Standards Codification ASC 958, *Not-for-Profit Entities*. Under FASB ASC 958, the Organization is required to report information regarding its financial position and activities according to three classes of net assets: unrestricted net assets, temporarily restricted net assets, and permanently restricted net assets.

4. *Assets, Liabilities and Net Assets*

Cash and cash equivalents: Cash and cash equivalents consist of cash held in checking, savings and money market accounts in one bank in Carlsbad, New Mexico. Amounts on deposit are insured by the Federal Deposit Insurance Corporation up to $250,000.

Grant receivable: Grant receivable represents reimbursement amounts received from the Department of Energy subsequent to year-end, for expenditures applicable to the period prior to year-end. The organization considers the receivables to be fully collectable, thus no allowance for uncollectable amounts is considered necessary.

Prepaid expenses: Prepaid expenses include insurance premiums paid or incurred prior to year-end for the following year, prepaid rent and prepaid services.

Unbilled revenue: Unbilled revenue is revenue earned under grants received from the Department of Interior that has not yet been billed.

NOTE A **Summary of Significant Accounting Policies** (continued)

5. *Assets, Liabilities and Net Assets* (continued)

Property and Equipment: The Organization capitalizes all expenditures for property and equipment in excess of $500. Purchased property and equipment are carried at cost. Depreciation is computed using the straight-line method. The estimated useful lives of the assets range from three (3) to fifteen (15) years.

Net Assets: Contributions received are recorded as increases in unrestricted, temporarily restricted, or permanently restricted net assets, depending on the existence and/or nature of any donor restrictions.

Income Taxes: The Organization is a not-for-profit organization that is exempt from income taxes under Section 501(c)(3) of the Internal Revenue Code.

6. *Estimates*

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect certain reported amounts and disclosures. Accordingly, actual results could differ from those estimates. A significant estimate utilized in the preparation of these financial statements was the estimated lives of depreciable assets.

7. *Description of Program and Supporting Services*

Research and Development – Alternative Fuel Studies: The biodiesel project is a research and development project investigating biodiesel production processes and the propagation, harvesting, and extraction of oil from both brine and fresh water algae. The business of biodiesel production and the impact of the future use of algae oil as a feedstock are being researched. Use of algae as a biodiesel feedstock has great potential to make biodiesel a viable replacement for significant quantities of petro diesel, thereby reducing American dependence on foreign oil. Since southeastern New Mexico has been identified as an ideal area for algae propagation, discoveries related to processes for harvesting and extraction of oil from algae have the potential to create a strong new industry for the region.

Education: The education project encompasses various activities designed to disseminate information to the general public and to the public schools about hazardous materials management and the Organization's projects. The Organization's personnel conduct tours of the biodiesel and algae facilities for student groups and other interested parties. They visit the public schools and deliver information at conferences and public forums on renewable energy research, biomonitoring, and hazardous materials management. The Organization regularly contributes to books, other publications, and films about renewable energy. In addition, the Organization has developed a written curriculum in alternative energy and renewable biofuels and a second on conservation and is working to provide these curricula to the public schools.

Biomonitoring: The biomonitoring project is directed toward detecting the H5N1 virus, the West Nile virus, banned pesticides and heavy metals. The project has monitored a scavenger species, the Chihuahuan Raven, in areas of west Texas, southern New Mexico, and the adjacent U.S.-Mexico border areas. The arrival of the H5N1 virus in the United States is a matter of national security and is of nationwide importance. Early detection is key to deterring the spread of the virus and protecting human health from possible communicable mutations of the virus.

NOTES TO THE FINANCIAL STATEMENTS

NOTE A **Summary of Significant Accounting Policies** (continued)

7. *Description of Program and Supporting Services (continued)*

Conservation: The candidate conservation project proposes to develop solutions for issues related to the Endangered Species Act (ESA) and its potential effect on environmental uses of land. Stakeholders from commercial, regulatory, and special interests organizations have met to develop a southeast New Mexico regional conservation plan concerning listed wildlife, namely the lesser prairie chicken and sand dune lizard. The Organization will work with stakeholders for the purpose of improving native short-grass sand scrub, sand dunes, and desert grassland habitats of southeastern New Mexico by fostering cooperative partnerships that meet the land stewardship goals of private landowners as well as the goal of conserving diminishing species and habitats.

8. *Fair Value of Financial Instruments*

The Organization's significant financial instruments are cash and other short-term assets and liabilities. For these financial instruments, carrying value approximates fair value.

NOTE B **Property and Equipment**

Property and equipment consist of the following:

	2010	2009
Nondepreciable:		
Work in process	$ 27,101	$118,246
Depreciable:		
Furniture and fixtures	559,707	466,465
Leasehold improvements	546,820	111,914
Buildings	19,990	13,795
Vehicles	115,181	93,415
Total property and equipment	1,268,799	803,835
Less: accumulated depreciation	(310,375)	(213,467)
Net property and equipment	$ 958,424	$590,368

Depreciation expense was $118,994 and $86,546 for the years ended September 30, 2010 and 2009, respectively.

NOTES TO THE FINANCIAL STATEMENTS

NOTE C Temporarily Restricted Net Assets

Temporarily restricted net assets are available to facilitate the Bureau of Land Management's (BLM) land management in accordance with the memorandum of agreement as well as the Candidate Conservation Agreement (CCA) between the Organization and the BLM. In addition, Supplemental Environmental Project payments are restricted for the Algae to Biofuels Project.

NOTE D Concentration of Grants

Approximately 28% and 95% of the Organization's funding for the years ended 2010 and 2009 and 100% of the grant receivable at September 30, 2010 and 2009 are from grants from the U.S Department of Energy.

Approximately 56% and 0% of the Organization's funding for the years ended September 30, 2010 and 2009 is from Supplemental Environmental Project payments in lieu of payment to the State of New Mexico as a civil penalty.

In the current year 84% of the Organization's total revenue comes from the U.S. Department of Energy and Supplemental Environmental Project payments. Other support is provided by contributions and consulting income.

It is reasonably possible that revenues from the above disclosed sources may be lost in the near term as a result of reduction in funding from the Department of Energy and the cessation of Supplemental Environmental Project payments. The current level of the Organization's operations may be impacted if the funding is not renewed.

NOTE E Commitments

The organization leases two buildings and a copier on long-term non-cancelable operating leases. On July 20, 2010, the Organization renewed its lease for its office at 505 North Main Street in Carlsbad for an additional year, ending on July 31, 2011. On September 3, 2010, the Organization renewed its lease for the property located at 67 East Four Dinkus Road in Artesia for one year ending on September 15, 2011. Rental expense for those leases was $44,436 and $42,980 for the years ended September 30, 2010 and 2009, respectively.

NOTE F Defined Contribution Plan

On June 17, 2005 the Organization initiated a defined contribution pension plan (Plan) covering all employees who have attained the age of 18. Participants may elect to make salary deferral contributions to the Plan up to the amount as limited by federal law and the Organization will match that contribution up to 5% of the participant's eligible compensation. The Organization can terminate the Plan at any time. The amount contributed to the Plan by the Organization was $55,206 and $55,441 for the years ended September 30, 2010 and 2009, respectively. This amount is included in benefit expenses.

NOTES TO THE FINANCIAL STATEMENTS

NOTE G Functional Classification of Expenses

Expenses by function for the years ended September 30, 2010 and 2009 were as follows:

Expenses	2010	2009
Program services		
Research development and testing	$ 1,378,006	$ 1,294,335
Center management	469,884	423,326
Information and technical support	-	96,569
Cooperative conservation	119,403	42,868
Education	8,994	41,138
CCA/CCAA	37,856	-
Monitoring	-	141,643
Supporting services		
Administration and general	765,904	648,622
	$ 2,780,047	$ 2,688,501

NOTE H Date of Management Review

The organization has evaluated subsequent events through January 15, 2011, the date which the financial statements were available to be issued.

COMPLIANCE SECTION

JOHNSON, MILLER & CO.
Certified Public Accountants
A Professional Corporation
An Independent Member Of BDO Seidman Alliance

Hobbs, New Mexico
Midland, Texas
Odessa, Texas

REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING AND ON COMPLIANCE AND OTHER MATTERS BASED ON AN AUDIT OF FINANCIAL STATEMENTS PERFORMED IN ACCORDANCE WITH *GOVERNMENT AUDITING STANDARDS*

To the Board of Directors
Center of Excellence for Hazardous Materials Management
Carlsbad, New Mexico

We have audited the financial statements of the Center of Excellence for Hazardous Materials Management, as of and for the year ended September 30, 2010 and have issued our report thereon dated January 15, 2011. We conducted our audit in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States.

Internal Control Over Financial Reporting

In planning and performing our audit, we considered the Center of Excellence for Hazardous Materials Management's internal control over financial reporting as a basis for designing our auditing procedures for the purpose of expressing our opinion on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of the Center of Excellence for Hazardous Materials Management's internal control over financial reporting. Accordingly, we do not express an opinion on the effectiveness of the Organization's internal control over financial reporting.

A *deficiency in internal control* exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct misstatements on a timely basis. A *material weakness* is a deficiency, or a combination of deficiencies, in internal control such that there is a reasonable possibility that a material misstatement of the entity's financial statements will not be prevented, or detected and corrected on a timely basis.

Our consideration of internal control over financial reporting was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control over financial reporting that might be deficiencies, significant deficiencies, or material weaknesses. We did not identify any deficiencies in internal control over financial reporting that we consider to be material weaknesses, as defined above.

Compliance and Other Matters

As part of obtaining reasonable assurance about whether the Center of Excellence for Hazardous Materials Management's financial statements are free of material misstatement, we performed tests of its compliance with certain provisions of laws, regulations, contracts and grant agreements, noncompliance with which could have a direct and material effect on the determination of financial statement amounts. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests disclosed no instances of noncompliance or other matters that are required to be reported under *Government Auditing Standards*.

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This report is intended solely for the information and use of management, the Board of Directors, others within the entity, federal awarding agencies and pass-through entities and is not intended to be and should not be used by anyone other than these specified parties.

Johnson, Miller & Co.

Hobbs, New Mexico
January 15, 2011

FEDERAL FINANCIAL ASSISTANCE

JOHNSON, MILLER & CO.
Certified Public Accountants
A Professional Corporation
An Independent Member Of BDO Seidman Alliance

Hobbs, New Mexico
Midland, Texas
Odessa, Texas

REPORT ON COMPLIANCE WITH REQUIREMENTS APPLICABLE TO EACH MAJOR PROGRAM AND ON INTERNAL CONTROL OVER COMPLIANCE IN ACCORDANCE WITH OMB CIRCULAR A-133

To the Board of Directors
Center of Excellence for Hazardous Materials Management
Carlsbad, New Mexico

Compliance

We have audited the compliance of the Center of Excellence for Hazardous Materials Management with the types of compliance requirements described in the U.S Office of Management and Budget (OMB) *Circular A-133 Compliance Supplement* that could have a direct and material effect on each of its major federal programs for the year ended September 30, 2010. The Center of Excellence for Hazardous Materials Management's major federal programs are identified in the summary of auditor's results section of the accompanying schedule of findings and questioned costs. Compliance with the requirements of laws, regulations, contracts, and grants applicable to each of its major federal programs is the responsibility of the Center of Excellence for Hazardous Materials Management's management. Our responsibility is to express an opinion on the Center of Excellence for Hazardous Materials Management's compliance based on our audit

We conducted our audit of compliance in accordance with auditing standards generally accepted in the United States of America; the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States; and OMB Circular A-133, *Audits of States, Local Governments, and Non-Profit Organizations*. Those standards and OMB Circular A-133 require that we plan and perform the audit to obtain reasonable assurance about whether noncompliance with the types of compliance requirements referred to above that could have a direct and material effect on a major federal program occurred. An audit includes examining, on a test basis, evidence about the Center of Excellence for Hazardous Materials Management's compliance with those requirements and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion. Our audit does not provide a legal determination of Center of Excellence for Hazardous Materials Management's compliance with those requirements.

In our opinion, the Center of Excellence for Hazardous Materials Management complied, in all material respects, with the compliance requirements referred to above that could have a direct and material effect on each of its major federal programs for the year ended September 30, 2010.

Internal Control Over Compliance

The management of the Center of Excellence for Hazardous Materials Management is responsible for establishing and maintaining effective internal control over compliance with the requirements of laws, regulations, contracts, and grants applicable to federal programs. In planning and performing our audit, we considered the Center of Excellence for Hazardous Materials Management's internal control over compliance with the requirements that could have a direct and material effect on a major federal program in order to determine the auditing procedures for the purpose of expressing our opinion on compliance and to test and report on internal control over compliance in accordance with OMB Circular A-133, but not for the purpose of expressing an opinion on the effectiveness of internal control over compliance. Accordingly, we do not express an opinion on the effectiveness of the Center of Excellence for Hazardous Materials Management's internal control over compliance.

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A *deficiency in internal control over compliance* exists when the design or operation of a control over compliance does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, noncompliance with a type of compliance requirement of a federal program on a timely basis. A *material weakness in internal control over compliance* is a deficiency, or combination of deficiencies, in internal control over compliance, such that there is a reasonable possibility that material noncompliance with a type of compliance requirement of a federal program will not be prevented, or detected and corrected, on a timely basis.

Our consideration of internal control over compliance was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control over compliance that might be deficiencies, significant deficiencies or material weaknesses. We did not identify any deficiencies in internal control over compliance that we consider to be material weaknesses, as defined above.

This report is intended solely for the information and use of management, the Board of Directors, others within the entity, federal awarding agencies and pass-through entities and is not intended to be and should not be used by anyone other than these specified parties.

Johnson, Miller & Co.

Hobbs, New Mexico
January 15, 2011

Center of Excellence for Hazardous Materials Management
Schedule of Expenditures of Federal Awards
For the year ended September 30, 2010

Grant Title	Grant Number	Federal CFDA Number	Program or Award Amount	Expenditures
U.S. Department of Energy				
Alternative energy, research and education	DE-SC0000581	81.049	$ 1,849,716	$ 1,351,431 (1)
U.S. Department of Interior				
Lesser Prairie Chicken Habitat Restoration "ARRA"	1448-20181-09-R-J004	15.656	117,000	81,609
			$ 1,966,716	$ 1,433,040

(1) Denotes Major Federal Financial Assistance Program

Note: This schedule is presented on the program's basis of accounting. The information in this schedule is presented in accordance with OMB Circular A-133, *Audits of States, Local Governments, and Non-Profit Organizations.*

The accompanying notes are an integral part of these financial statements.

Center of Excellence for Hazardous Materials Management
Schedule of Findings and Questioned Costs
September 30, 2010

PROGRAM	DESCRIPTION
Type of Report on Financial Statements	Unqualified opinion
Significant Deficiencies	None
Material Weaknesses Involving Significant Deficiencies	None
Noncompliance Material to the Financial Statements	The level of noncompliance was not material in relation to financial statements covering federal programs
Type of Report on Compliance with Major Programs	Unqualified opinion
Findings and Questioned Costs for Federal Awards	None
Dollar Threshold Considered Between Type A and Type B Programs	$300,000
Low Risk Auditee Statements	The Organization was classified as a low-risk auditee in the context of OMB Circular A-133
Major Federal Programs	US Department of Energy Grants DE-SC0000561
Pass Through Entity	None

Center of Excellence for Hazardous Materials Management
Schedule of Status of Prior Year Findings
September 30, 2010

SCHEDULE REFERENCE NUMBER: 09-1 Cash management

Grant advances were not expended in a timely manner.

Resolved - finding will not be repeated.

#1
#6

CENTER OF EXCELLENCE FOR HAZARDOUS MATERIALS MANAGEMENT (CEHMM)
LOCAL ECONOMIC DEVELOPMENT APPLICATION
(REQUIREMENTS SEC. 38-72)
FEBRUARY 2012

1. Identification information

1.a. Complete name and address of qualifying entity:

Center of Excellence for Hazardous Materials Management Inc.
505 N. Main Street
Carlsbad, NM 88220

1.b. Incorporation papers and by-laws:

Attached

1.c. List of board of directors and executive directors, with addresses:

Attached

1.d. Resumes of all directors and officers:

Attached

2. Evidence of financial solvency

2.a. Financial Statements for past three years:

Attached (2009 and 2010 audited financials provided, 2011 income statement and balance sheet provided as audit has not been completed)

2.b. Federal tax numbers, New Mexico State Taxation and Revenue Number and city business license:

CEHMM Federal Employer Identification Number: 90-0171217
CEHMM New Mexico CRS Number: 03-021-396-00-7
CEHMM City of Carlsbad Business Registration: ID 5448

2.c. Projected income statement for at least three years:

Attached

3. Evidence of organization capacity

3.a. Brief history of the qualifying entity:

Attached

3.b. Organizational chart of the qualifying entity:

Attached

3.c. Business plans for the qualifying entity and project:

Attached

3.d. Evidence of ability to manage the project:

1. *List and description of previously completed projects:*

   Attached

2. *Resumes of key staff:*

   Attached

3.e. The qualifying entity shall disclose the following information:

1. *Has the qualifying entity or any of its officers ever been involved in a bankruptcy?*

   No

2. *Has the qualifying entity for any of its officers ever defaulted obligations on which payments are not current?*

   No

3. *Does the qualifying entity have any loans or other financial obligations on which payments are not current?*

   No

4. Funding sources for the proposed economic development project

4.a. Equity investment of qualifying entity:

None

4.b. *Specific assistance being requested of the city:*

The requested equipment, see attached

4.c. *Funding sources other than the city with letters of commitment of intent to fund*:

None

5. *A complete and specific description of the proposed economic development project*

5.a. *Business activities to be conducted*:

Research and development

5.b. *Management and staffing requirements*:

Eight FTEs

5.c. *Property and equipment requirements*:

No additional property required and no additional equipment required except for what is being requested

5.d. *Markets:*

None

5.e. *Transportation requirements*:

None

5.f. *Utility requirements*:

No upgrades required

5.g. *Solid and liquid waste disposal requirements*:

None

5.h. *Infrastructure requirements*:

Just the items requested

5.i. Regulatory compliance requirements:

None

6. A complete and specific cost-benefit analysis. The cost-benefit analysis shall show that the city will recoup the value of its donation.

Attached

7. A complete and specific description of the proposed economic development project's substantive contributions to the city including, but not limited to such factors as in-kind services to the city, jobs, expanded tax base, property or other things or service of value for the expansion or improvements of the economy.

Attached

8. A complete and specific description of the employee job training and career development plan for the proposed economic project.

All employees are currently on staff so no training will be necessary.

9. Any other information necessary for the city to make a determination as whether or not the applicant is a qualifying entity.

N/A

10. Any other information required of the applicant by the city.

The Center of Excellence for Hazardous Materials Management will provide any additional information requested by the city in a timely manner.

CENTER OF EXCELLENCE FOR HAZARDOUS MATERIALS MANAGEMENT
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CENTER OF EXCELLENCE FOR HAZARDOUS MATL
Statement of Financial Position
September 30, 2011

ASSETS

Current Assets			
Petty Cash	$	500.00	
CNB - CEHMM Operating		45,213.17	
CNB - CEHMM Savings		236,213.80	
CNB - Federal Grant #4		3,474.06	
CNB - Conservation Fund		126,207.30	
CNB - CCA/CCAA		1,416,161.36	
CNB - NMED-SEP #1		37,089.41	
CNB - NMED SEP #2		253,092.71	
Accounts Receivable		20,000.00	
Reimbursable Expenses		211.80	
Prepaid Rent		1,750.00	
Prepaid Insurance		10,943.90	
Deposits		195.00	
Total Current Assets			2,151,052.51
Property and Equipment			
Furniture & Equipment-CEHMM		591,672.65	
Vehicles		144,030.18	
Building		21,584.89	
Lease Improvements		546,819.93	
Work In Process		25,819.53	
Accum. Depreciation - F & E		(286,386.55)	
Accumulated Depreciation-Vehic		(75,315.98)	
Accumulated Depreciation-Build		(6,458.11)	
Accumulated Depreciation - Le		(84,415.36)	
Total Property and Equipment			877,351.18
Total Assets			$ 3,028,403.69

LIABILITIES AND CAPITAL

Current Liabilities			
Accounts Payable	$	117,887.44	
Wells Fargo CC - Carrasco		549.88	
Wells Fargo CC - Lynn		805.04	
Wells Fargo CC - Foster		344.71	
Amer Express CC - Brown		3,227.79	
Accrued Payroll		32,724.10	
FUTA/SUTA Payable		554.53	
State Income Taxes Payable		1,925.73	
Accrued PTO		59,990.38	
Total Current Liabilities			218,009.60
Total Liabilities			218,009.60
Net Assets			
Net Assets-Unrestricted		852,589.35	
Net Asset-Restricted-Temp		2,127,360.14	
Net Income		(169,555.40)	
Total Net Assets			2,810,394.09
Total Liabilities & Net Assets			$ 3,028,403.69

CENTER OF EXCELLENCE FOR HAZARDOUS MATL
Statement of Activities
For the Twelve Months Ending September 30, 2011

	Current Month	Year to Date
Revenues		
Consulting Services	$ 0.00	$ 2,335.43
Federal Grants - DOE #4	0.00	729,000.00
Federal Coop Agrmnt - DOI F&W	0.00	35,391.31
Contribution Revenue	270,000.00	1,663,712.82
In-kind Revenue	4,000.00	48,000.00
Administrative Income	0.00	14,949.36
Exclusive Rights Income	0.00	0.00
Interest Income	892.09	4,088.12
Retained PTO-Unrestricted	1,034.31	7,424.11
Other Income	200.00	200.00
Cash Over/Short	0.00	0.00
Total Revenues	276,126.40	2,505,101.15
Personnel Expenses		
Salaries	66,003.02	718,647.23
Hourly	22,526.37	295,041.51
Overtime	0.00	3,822.75
Part-time	0.00	0.00
Driver Stipend	0.00	1,674.00
Incentive Award	0.00	0.00
Severance Pay	0.00	1,730.77
Paid Time Off	3,460.25	48,898.42
Accrued PTO Earned	6,408.00	101,852.81
PR Taxes Exp-CEHMM Admin.	5,006.23	82,840.31
Health Ins - CEHMM Admin	8,500.53	178,696.50
Dental Ins. - CEHMM Admin.	621.89	11,447.40
Worker's Comp	1,161.75	15,237.10
401 K Expense	2,902.24	48,291.53
FUTA/SUTA	65.97	5,761.00
Life Ins - CEHMM Admin	255.36	4,761.60
AD&D	10.64	198.40
Short-Term Disability	186.42	3,736.68
Long-Term Disability	211.90	4,321.85
Total Personnel Expenses	117,320.57	1,526,959.86
Direct Expenses		
Computers & Software	105.13	174.38
Lease Expense	2,500.00	30,000.00
Equipment	(48,148.96)	2,435.45
Equipment R & M	1,521.35	16,377.46
In-kind Equipment Rental	4,000.00	48,000.00
Equipment Rental	4.45	476.72
Furniture	0.00	0.00
Supplies	6,029.71	78,112.32
Contract Services	111,214.25	597,004.23
Technical Consulting	0.00	0.00
Insurance	0.00	0.00
Travel	1,504.65	18,226.57
Training	0.00	1,977.41
Conferences	0.00	586.32
Direct Material	(31.42)	2,762.98
License & Permits	0.00	277.37
Vehicle R & M	374.86	7,882.08
Meetings	227.86	823.98

CENTER OF EXCELLENCE FOR HAZARDOUS MATL
Statement of Activities
For the Twelve Months Ending September 30, 2011

	Current Month	Year to Date
Total Direct Expenses	79,301.88	805,117.27
Operating Expenses		
O&M - Rent	2,900.00	33,200.00
O&M - Utilities	1,168.56	24,259.00
O&M - Building R&M	35.87	198.56
O&M - Equipment R&M	0.00	84.00
O&M - Equipment Rental	356.92	4,643.11
O&M - Computer R&M	100.28	6,521.89
O&M - Security	70.44	422.64
O&M - Janitorial Services	252.48	3,008.27
O&M - Janitorial Supplies	41.45	541.73
O&M - Prop & Liab. Insurance	2,291.80	27,659.67
O&M - Vehicle R&M	0.00	2,407.36
O&M - Indirect Allocation	(7,217.80)	(102,946.23)
O&M - Indirect Allocation-GF	15.64	2,032.70
O&M - Indirect Allocation-EIF	0.00	70.68
O&M - Indirect Allocation CCA	4,220.27	21,542.24
O&M - Indirect Allocation-SEP1	0.00	28,697.77
O&M - Indirect Allocation-SEP2	2,981.89	24,037.08
O&M - Indirect Allocation #4	0.00	26,565.76
G&A - Employee Screening Svcs	0.00	289.91
G&A - Training Exp	0.00	2,433.74
G&A - Travel Exp	(16.40)	5,280.37
G&A - Meetings & Conferences	0.00	1,056.01
G&A - Directors Insurance	147.50	1,713.32
G&A - Acctg Prof. Services	0.00	27,664.44
G&A - Legal Prof. Services	0.00	10,755.75
G&A - Equipment Rental	12.36	148.32
G&A - Supplies	144.20	6,502.70
G&A - Assets Less Than $500	0.00	346.69
G&A - Assets over $500	(1,675.03)	0.00
G&A - Telephone	709.67	10,487.16
G&A - Internet Service	324.85	3,898.20
G&A - Resource Materials	0.00	125.24
G&A - Postage & Delivery Exp	103.80	2,922.43
G&A - Misc. Exp	43.73	1,178.22
G&A Expense Overhead	0.00	14,949.36
G&A - Indirect Allocation	(1,469.71)	(76,477.53)
G&A - Indirect Allocation-GF	3.19	946.27
G&A - Indirect Allocation-EIF	0.00	49.56
G&A - Indirect Allocation CCA	859.34	12,291.19
G&A - Indirect Allocation SEP1	0.00	33,679.15
G&A - Indirect Allocation SEP2	607.18	18,895.34
G&A - Indirect Allocation #4	0.00	10,616.02
Unallowable Costs - Entertainm	0.00	439.46
Unallowable Costs - Other	0.00	1,860.84
Unallowable Costs - Deprec & A	146,882.02	146,882.02
Unallowable Costs-Loss on Disp	699.01	699.01
Total Operating Expenses	154,593.51	342,579.42
Net Income	$ (75,089.56)	$ (169,555.40)

Recipient Report: Grant or Loan	Version: 1.5
Prime Recipient	

Reporting Information		
Award Type*	Award Number*	Final Report*
Grant	20181RJ004	Y

Award Recipient Information		
Recipient DUNS Number*	Recipient Account Number	Recipient Congressional District*
147349794		02

Award Information		
Funding Agency Code*	Awarding Agency Code*	Award Date*
1448	1448	07/21/2009
Amount of Award*	CFDA Number*	
$117,000.00	15.656	
Program Source (TAS)*	Sub Account Number for Program Source (TAS)	
14-1610		
Total Number of Sub Awards to Individuals*	Total Amount of Sub Awards to Individuals*	
0.00	$0.00	
Total Number of Payments to Vendors less than $25,000/award*	Total Amount of Payments to Vendors less than $25,000/award*	
52.00	$29,091.73	
Total Number of Sub Awards less than $25,000/award*	Total Amount of Sub Awards less than $25,000/award*	
0.00	$0.00	

Need Help Finding Award Information?	
Browse the Full Listings by using the drop-down lists.	
Agency Drop-Down List:	1448 - U.S. Fish and Wildlife Service
Program Source (TAS) Drop-Down List:	14-1610-Department of the Interior-U.S. Fish and Wildlife Service-Resource Management, Recovery Act
Know the code and want to check the name? Search by Code	
Enter Agency Code:	1448
Agency Name:	U.S. Fish and Wildlife Service
Enter Program Source (TAS) Code:	14-1610
Program Source (TAS) Name:	Department of the Interior-U.S. Fish and Wildlife Service-Resource Management, Recovery Act
Know the name and want to find the code? Search by Name	
Enter Agency Name:	U.S. Fish and Wildlife Service
Agency Code:	1448
Enter Program Source (TAS) Name:	Department of the Interior-U.S. Fish and Wildlife Service-Resource Management, Recovery Act

Award Description*
This Award (Cooperative Agreement) is being implemented in order for the Service and the Cooperator to work together on privately owned lands for the purpose of improving native short-grass sand scrub, sand dunes, and desert grassland habitats of southeastern New Mexico by fostering cooperative partnerships that meet the land stewardship goals of private landowners as well as the goal of conserving diminishing species and habitats. The goals of this cooperative agreement are to: 1) conserve and restore short- and midgrass sand scrub, sand dunes, desert grasslands; 2) improve the status of federally listed or candidate species (e.g., the lesser prairie-chicken (LPC) and dunes sagebrush lizard (DSL), at-risk species, and diminishing migratory and resident non-game species that depend on these vital habitats); and 3) reduce or remove the need for protection of these species and their habitats under the Endangered Species Act (ESA).
Number of characters entered: 944

Program Source (TAS) Code:	14-1610

Project Information		
Project Name or Project/Program Title*	Project Status*	Total Federal Amount ARRA Funds Received/Invoiced*
R2EC-Lesser Prairie Chicken Habitat Restoration	Fully Completed	$117,000.00

Number of Jobs*	Description of Jobs Created*
0.13	During QE 06/30/11, a Pilot and Chemical Mix Load Technicians were retained to perform an aerial mesquite spray and a Senior Field Technician along with Field Technicians monitored activities on the ground. Cumulatively, the award has enabled the Prime Recipient to fully fund 13 Field Technicians and partially fund one Senior Field Technician, one Pilot, one Driver, and two Load Technicians. Technicians have conducted activities in support of a wildlife conservation program.
	Number of characters entered: 483

Quarterly Activities/Project Description*
During QE 06/30/11 the prime recipient worked with a private landowner and performed an aerial application of pesiticides on mesquite covering 2,732 acres. Field Technicians on the ground monitored wind speed and temperature to ensure the spray was completed according to BLM stiputlations. Cumulatively, in collaboration with landowners, Prime Recipient performed mesquite sprays for control of invasive plant species and fence removal impacting 5,999 acres in support of conservation efforts for the benefit of the at-risk Lesser Prairie Chicken and other grassland birds for the purpose of habitat improvement.
Number of characters entered: 619

Need Help Finding an Activity, State, or Country Code?

Activity Code (NAICS or NTEE-NPC)*			
1	813312	2	
3		4	
5		6	
7		8	
9		10	

Total Federal Amount of ARRA Expenditure*	Total Federal ARRA Infrastructure Expenditure	Infrastructure Contact Name
$117,000.00		
Infrastructure Contact Email	**Infrastructure Contact Phone**	**Infrastructure Contact Phone Ext**
Infrastructure Contact Street Address 1	**Infrastructure Contact Street Address 2**	**Infrastructure Contact Street Address 3**
Infrastructure City	**Infrastructure State**	**Infrastructure ZIP Code+4**

Infrastructure Purpose and Rationale

Number of characters entered: 0

Browse the Full Listing by using the drop-down list.	
Activity Code Drop-Down List:	813312 - Environment, Conservation and Wildlife Organizations
State Drop-Down List:	NM - New Mexico
Country Drop-Down List:	US - United States
Know the code and want to check the name? Search by Code	
Enter Activity Code:	813312
Activity Name:	Environment, Conservation and Wildlife Organizations
Enter State Code:	NM
State Name:	New Mexico
Enter Country Code:	US
Country Name:	United States
Know the name and want to find the code? Search by Name	
Enter Activity Name:	Environment, Conservation and Wildlife Organizations
Activity Code:	813312
Enter State Name:	New Mexico
State Code:	NM
Enter Country Name:	United States
Country Code:	US

Primary Place of Performance		
Street Address 1	**Street Address 2**	**City***
505 N. Main		Carlsbad

State*	ZIP Code+4*	Congressional District*
NM	882205875	02
Country*		
US		

Recipient Highly Compensated Officers			
Prime Recipient Indication of Reporting Applicability*	**#**	**Officer Name**	**Officer Compensation**
No	1		
	2		
	3		
	4		
	5		

Recipient Report: Grant or Loan **Version: 1.5**

Vendors

Reporting Information
Award Number*
20181RJ004

No.	Subaward Number(*)	Vendor DUNS Number(*)	Vendor Name(*)	Vendor HQ ZIP Code+4(*)	Product and Service Description	Payment Amount
1		802867700	Carlsbad Soil and Water Conservation District		Aerial application of pesticide to eradicate invasive mesquite	$34,497.94
2						
3						
4						

CEHMM Center of Excellence for Hazardous Materials Management

505 North Main Street • Carlsbad, New Mexico 88220 • 575.885.3700 • FAX 575.885.6422 • www.cehmm.org

October 27, 2011

Ms. Debra McElroy, Section Chief
Enforcement & Compliance
NM Air Quality Bureau
1301 Siler road, Bldg. B
Santa Fe, NM 87507

Dear Ms. McElroy:

Pursuant to our receipt of a Supplemental Environmental Project (SEP), the Center of Excellence for Hazardous Materials Management (CEHMM) is pleased to provide this final report on the activities of CEHMM as they relate to the algae project.

The first six months of 2011 proved to be an exceptional year for algae growth and harvesting. The conditions were favorable for algal growth despite the drought conditions and abnormally high temperatures. CEHMM harvested more algae and extracted more oil during these spring months than it had during the past growing seasons.

As the summer months set in and the temperatures continued to rise, the intense heat and the lack of geothermal cooling began to cause problems with the health of our cultures. Our in ground lined ponds began to cause unfavorable growth conditions for our algae cultures where our above ground test tanks were still surviving the heat. CEHMM researchers have been working with different algae species and pond modifications to remediate abnormal weather conditions such as those in 2011 where temperatures were above 100 degrees for more than 60 days straight and no measurable rainfall for almost a year.

Our oil extraction equipment has proven to be an exceptional tool in the removal of oil from algae. The CEHMM team has managed to increase the unit's efficiency and maximize its output to produce high quality oil that could compete in markets pertaining to fuel and nutrients such as omega-3s. With its flexibility in extracting oil from different species of algae, the AlgalFrac unit has proven to be one of the leading systems in lipid removal. Aside from extracting algae oil from our own cultures, CEHMM has recently had the opportunity to extract oil from an overseas algae company to determine its species flexibility and efficiency in algae oil removal from spray dried algae. Aside from oil extraction and testing of the oil, CEHMM has made 200 gallons of an algal based fuel which has been used to power a John Deere Diesel UTV.

A new water movement system has been placed in one of our ponds as an experiment for reduction in evaporation and increase water movement. The new system is more efficient than the traditional water circulation paddles, but they go one step further in efficiency by pushing air into our ponds which eliminates the air blowers that are currently used for air induction. If this new water movement system proves to be ideal for algae culturing, the cost of constructing and maintaining a pond will decrease significantly thus making algae a more feasible feedstock. Another advantage to using this system is the ease of infusing CO2 into the pond system. With this system, CO2 sequestration in an open pond could become an efficient means of feeding an algae culture and reducing the amount of CO2 released into the atmosphere.

Part of the SEP funds was to be used for the experimentation of using produced water from the oil and gas industry for the cultivation of algae. Our researchers have experimented with several different produced waters from different parts of southeastern New Mexico. Our laboratory results prove that produced water from oil and gas is a viable media for the culturing of algal feedstock. The next step in our quest for the use of these non-beneficial waters would be to reduce state regulations in order to cultivate an algae crop at a large scale.

As the fall season sets in and the temperatures on a steady decline, our cultures are back on track and growing well. I would like to invite you to visit our facility and maybe even take a ride on our UTV that is powered by an algal based fuel. Please feel free to contact me with any questions or information you may need.

Sincerely,

Douglas C. Lynn
Executive Director

LC: ss

cc: L. Allen, WR

EXHIBIT "B"

PROJECT PARTICIPATION AGREEMENT BETWEEN
THE CITY OF CARLSBAD AND
THE CENTER OF EXCELLENCE FOR
HAZARDOUS MATERIALS MANAGEMENT

This Agreement is entered into on this ____ day of _____, 2012, between the City of Carlsbad (hereinafter" City"), a New Mexico Municipal Corporation and the Center of Excellence for Hazardous Materials Management, a New Mexico domestic Nonprofit Corporation (hereinafter 'CEHMM); collectively, the "Parties."

WHEREAS, CEHMM is a New Mexico Domestic Nonprofit Corporation incorporated to promote excellence in hazardous materials management;

WHEREAS, City desires to assist CEHMM in the development and implementation of a project at a facility in or near the City of Carlsbad that will promote job growth and economic development within the City; and

WHEREAS, CEHMM desires to operate such a facility for a project to research, produce, market and distribute algal-based nutraceuticals, nutritional products, and/or biofuel; and

WHEREAS, certain items of tangible personal property were acquired by the City and made available to CEHMM under the terms and conditions of the State of New Mexico Governmental Services Agreement Between the Energy, Minerals and Natural Resources Department and the City of Carlsbad, EMNRD Contract No. 09-521-A083068-0073, in which the City acted as fiscal agent; and

WHEREAS, CEHMM successfully demonstrated its ability to produce such algal-based nutraceuticals, nutritional products, and biofuel during the project funded by the above-described agreement; and

WHEREAS, such items of tangible personal property have no value or very limited value in the conduct of normal City business; and

WHEREAS, the City desires to contribute that tangible personal property to CEHMM for the purposes set forth herein and subject to the terms and conditions set forth herein; and

WHEREAS, a cost/benefit analysis reflects that the City will recoup the value of its contribution from the operation of CEHMM's project during the term of this Agreement; and

WHEREAS, pursuant to Ordinance No. 2000-08, City of Carlsbad Economic Development Plan Ordinance, codified as Chapter 38, Article IV of the Carlsbad City Code, CEHMM has made application to the City for public support for its project; and

WHEREAS, such application has met the requirements set forth in the Economic Development Plan Ordinance.

NOW, THEREFORE, THE PARTIES in consideration of the mutual covenants and agreements herein contained agree as follows:

1. Definitions.

A. "Agreement" shall mean this Project Participation Agreement between the City of Carlsbad and CEHMM.

B. "Board" shall mean CEHMM's Board of Directors as set forth in the corporation's bylaws dated October 2, 2007, as such may be amended from time to time.

C. "Business Plan" shall mean CEHMM's Business Plan attached hereto as Exhibit 1 and incorporated by reference.

D. "Carlsbad Facility" shall mean the property leased by CEHMM from New Mexico State University in South Eddy County, as reflected in Exhibit 2 attached hereto, for the placement and operation of the Tangible Personal Property for use in the Carlsbad Project.

E. "Carlsbad Project" shall mean the research, development, and commercialization of technologies at the Carlsbad Facility to produce and market, or cause to be produced and marketed, algal-based human and animal nutraceuticals, nutritional products, and / or biofuel.

F. "CEHMM" shall mean the Center of Excellence for Hazardous Materials Management, a New Mexico non-profit corporation.

G. "City" means the City of Carlsbad, a New Mexico municipal corporation.

H. "Economic Development Plan Ordinance" shall mean the City of Carlsbad Economic Development Plan Ordinance as set forth in the Carlsbad City Code, Sections 38-66, et seq., as it may be amended from time to time.

I. "Executive Director" shall mean CEHMM's Executive Director.

J. "Fair Market Value" shall mean either the:
(1) Appraised value of the Tangible Personal Property as determined by a competent authority; or
(2) Price negotiated in good faith between a willing purchaser and a willing seller.

K. "Governing Body" shall mean the duly-elected Mayor and City Council members

as set forth in NMSA 1978, Sections 3-11-1, et seq. and NMSA 1978, Sections 3-12-1, et seq.

L. "Job Plan" shall mean CEHMM's "Employee Job Training and Career Development Plan" attached hereto as Exhibit 3 and incorporated by reference.

M. "Ordinance" shall mean the ordinance to which this Participation Agreement is appended for formal approval by the Governing Body of the City of Carlsbad.

N. "Replacement Cost" shall mean the actual cost, at any given time, to replace any item of Tangible Personal Property with one of equal effectiveness.

O. "Residual Value" shall mean, for purposes of this Agreement, the value of the Tangible Personal Property as determined at any given point in time by the application of a straight-line depreciation formula to the original purchase price from the date of purchase. The Residual Value as of December 31, 2012, for each item of Tangible Personal Property is listed on Exhibit 4.

P. "Tangible Personal Property" shall mean the articles of tangible personal property enumerated and more particularly described in Exhibit 4 attached hereto and incorporated by reference and all items necessarily associated with those articles.

2. Effective Date.

The effective date of this Agreement shall be the later of:

A. Five (5) days after the date of the post-adoption public notice of the Ordinance or
B. January 1, 2013.

3. Term and Automatic Termination and Repeal of Ordinance.

This Agreement and Ordinance shall begin on the effective date specified in Paragraph 2 above and, unless terminated earlier in accordance with the provisions of Paragraph 4 or extended in accordance with the provisions of Paragraph 9(F) of this Agreement, shall automatically terminate on the tenth (10^{th}) anniversary of the date established in Paragraph 2, at which time the Ordinance shall automatically be repealed, and all duties and obligations of the Parties shall be deemed fully and completely discharged, except as provided for in Paragraph 12, Survival.

4. Early Termination.

A. By the City. The City may terminate this Agreement:
   (1) Pursuant to the provisions of Paragraph 10.A; or
   (2) In accordance with the applicable provisions of the Economic Development Plan Ordinance.

"B. By CEHMM. CEHMM may terminate this Agreement at any time by paying to the City in cash the Fair Market Value of the Tangible Personal Property.

5. Economic Development Goals of the Project.

The general economic goal of this Agreement and the Carlsbad Project is:

A. The creation and/or retention of six (6) full-time equivalent jobs in the City of Carlsbad with an annual payroll (base salaries and wages plus fringe benefits) of not less than six hundred seventy-four thousand four hundred ninety-six dollars ($674,496) as set forth in the Business Plan; and

B. The generation of New Mexico Gross Receipt Taxes in the City of Carlsbad and the surrounding area.

6. Obligations of CEHMM.

In consideration of the contributions by the City hereinafter specified, CEHMM shall:

A. Operate or cause to be operated the Carlsbad Project at the Carlsbad Facility in substantial accordance with this Agreement for a minimum of ten (10) years from the effective date specified in Paragraph 2, unless otherwise terminated as provided herein; operation of the Carlsbad Facility and Carlsbad Project shall substantially conform to the provisions of the Business Plan.

B. In good faith, utilize its best efforts to adhere to the Business Plan so that:

(1) Not later than January 1, 2013 CEHMM will employ or cause to be employed no fewer than six (6) people in Carlsbad or Eddy County directly related to the operation of the Carlsbad Project. Such employment shall be maintained throughout the term of this Agreement.

(2) Substantially conform in all material respects to all applicable provisions contained in:

(a) the Business Plan; and

(b) the Job Plan.

C. In good faith, subject only to delays outside CEHMM's control, utilize its best efforts to adhere to the operational time lines set forth in the Business Plan.

D. CEHMM shall use the Tangible Personal Property only for the operation of the Carlsbad Project at the Carlsbad Facility.

E. In addition to any other insurances required herein, CEHMM shall at all times during the term of this Agreement maintain at its own expense General Liability Insurance in an amount not less than one million dollars for a single occurrence. On the effective date of this Agreement as set forth in Paragraph 2 and annually thereafter, CEHMM shall provide the City a Certificate of Insurance reflecting the

specified coverage and naming the City as additional insured.

F. Provide the City with monthly written reports in sufficient detail by which the City may determine CEHMM's compliance in meeting each of CEHMM's obligations, performance objectives, and goals set forth in this Agreement. Such reports shall be in a form and contain such information as may be required by the City. At a minimum, the reports shall be submitted to the City Administrator as follows:

(1) Monthly, beginning thirty days after the effective date established in Paragraph 2, with such reports to include at a minimum:
(a) the status of the Carlsbad Project;
(b) the current number of employees solely and directly related to the operation of the Carlsbad Project at the Carlsbad Facility;
(c) the gross amount of wages and salaries and the gross amount of benefits paid to those employees described in Paragraph 6.B(1);
(d) the amount of New Mexico gross receipt taxes paid arising from the operation of the Carlsbad Project;
(e) the type and quantity of products the Carlsbad Project has produced at the Carlsbad Facility and has marketed in Eddy County; and
(f) the identity of the persons or businesses to which any products of the Carlsbad Project were marketed and the identity of those to which such products were sold.

(2) In addition to the monthly reports, CEHMM shall also provide an annual report to the Governing Body for the previous year summarizing the data required in the above Paragraph 6.F(1) and such other information as to accurately and completely describe the status and achievements of the Carlsbad Project during the previous calendar year. Such annual reports shall be submitted to the City Administrator not later than January 31 of each year.

G. Not later than ninety (90) days after the effective date of this Agreement, CHEMM shall demonstrate, to the City's satisfaction, that it has established a physical business presence for the Carlsbad Project within the Carlsbad City Limits for the remittance of Gross Receipts Taxes.

7. Contributions of the City.

A. In consideration of CEHMM's performance of its covenants and agreements, as specified in this Agreement, the City shall contribute to CEHMM the Tangible Personal Property enumerated and described in Exhibit 4. The Tangible Personal Property is acknowledged by both Parties to be in "used" condition.

B. Title to the Tangible Personal Property shall vest with CEHMM on the effective date of this Agreement subject to the applicable terms and conditions of this Agreement.

C. Prior to its execution of this Agreement, CEHMM has fully examined and inspected each item of Tangible Personal Property. CEHMM accepts the Tangible Personal Property in their existing condition and state of repair. CEHMM accepts them in an **AS IS CONDITION**. CEHMM agrees that no representations, statements, or warranties, express or implied, have been made by or on behalf of the City in any respect thereto, including, but not limited to their suitability for any purpose, and the City shall in no event be liable for any latent defects.

8. Public Safeguards for City Contribution.

In accordance with NMSA 1978, Section 5-10-6(B) (2007), as amended, and Section 38-75(b), of the Economic Development Plan Ordinance the following public safeguards are established for the City's contributions specified above:

A. CEHMM shall provide to the City an annual inventory of all Tangible Personal Property, describing each item's condition, location, and use.

B. CEHMM shall insure the Tangible Personal Property at all times during the term of this Agreement for not less than its Replacement Cost, with such insurance naming the City of Carlsbad as the Loss Payee. On the effective date of this Agreement as set forth in Paragraph 2 and annually thereafter, CEHMM shall provide the City a Certificate of Insurance reflecting the specified coverage and naming the City as Loss Payee.

C. CEHMM acknowledges and agrees that this Agreement constitutes a valid and binding lien in favor of the City on the Tangible Personal Property in the amount of the Residual Value of all the Tangible Personal Property, and all costs, fees and expenses incurred by or on behalf of the City. CEHMM further expressly agrees to waive any objection it might be legally entitled to raise regarding the form, filing, or validity of this Agreement constituting a valid lien on the Tangible Personal Property. CEHMM shall cooperate with the City as necessary to effectuate a proper lien on behalf of the City for all Tangible Personal Property, and to effectuate any other instrument required by the City to revert title to the Tangible Personal Property to the City in the Event of a Default or a breach of this Agreement by CEHMM.

D. CEHMM shall not subcontract, lease, assign, or sell any interest in this Agreement, the Carlsbad Project, or Carlsbad Facility except as provided in Paragraph 13.

9. Default or Breach.

Each of the following events shall constitute an Event of Default hereunder:

A. Bankruptcy Filing. If CEHMM shall file a petition in bankruptcy or insolvency or for reorganization under any bankruptcy act, or shall voluntarily take advantage of

any such act by answer or otherwise, or shall make an assignment for the benefit of creditors and such proceeding shall not be dismissed within sixty (60) days after its commencement.

B. Involuntary Proceedings. If involuntary proceedings under any bankruptcy law or insolvency act shall be instituted against CEHMM or if a receiver or trustee shall be appointed for all or substantially all of the property of CEHMM and such proceeding shall not be dismissed or the receivership or trusteeship vacated within sixty (60) days after the institution or appointment.

C. Failure to Comply. If CEHMM fails to perform or comply with any of the material conditions of this Agreement and if the nonperformance or noncompliance shall continue for a period of forty-five (45) days after notice thereof, or if the performance or compliance cannot be reasonably had within the ninety (90) day period and CEHMM shall not have commenced performance within the ninety (90) day period and then diligently proceeded to completion of performance.

D. Transfer of Agreement. If this Agreement shall be transferred to or shall pass to or devolve to any other person or party without the consent of the City, except in the manner specified herein, which consent shall not be unreasonably withheld.

E. Vacation of Use. If CEHMM shall vacate or abandon the Carlsbad Facility or Carlsbad Project without having first complied with the applicable provisions of this Agreement. Events constituting vacation or abandonment shall include, but not be limited to, the following:

(1) A cessation of Carlsbad Project business activity at the Carlsbad Facility for a period of forty-five (45) days or more; or

(2) A declaration by CEHMM that it will vacate or abandon the Carlsbad Project or the Carlsbad Facility; or

(3) Failure of CEHMM to respond in writing within thirty (30) days of a written request from the City for a declaration that CEHMM has not and does not intend to vacate or abandon the Property or Facility; or

(4) When the condition or the use of the Carlsbad Facility clearly indicates vacation or abandonment.

F. Damage or Destruction. If the improvements on the Carlsbad Facility or any portion thereof, are partially destroyed or damaged by fire or other casualty, then CEHMM, at its sole expense, shall restore and repair the improvements as soon as it is reasonably practicable. Such restoration and repair shall commence not later than six (6) months after such damage occurs, and shall be completed within six (6) months of the commencement date. Such restoration shall be to substantially the same condition in which the improvements were before such damage. Failure

of CEHMM to have commenced repairs or restoration within six (6) months shall constitute an Event of Default hereunder. If the destruction or damage causes the Carlsbad Project to be suspended or substantially suspended, then, the term of this Agreement and the Ordinance as set forth in Paragraph 3 shall be extended for a length of time equal to that of the suspension or substantial suspension.

10. Effect of Event of Default.

In the Event of Default hereinunder as set forth in this Agreement, the rights of the City shall be as follows:

A. Termination. The City shall have the right to cancel and terminate this Agreement in accordance with the provisions of the Economic Development Plan Ordinance. On the effective date of such termination, this Agreement and all rights, title and interest of CEHMM hereinunder shall terminate.

B. Return of Tangible Personal Property. The City shall have the right, in its sole discretion, to take title to and possession of the Tangible Personal Property or any portion thereof. The City and/or its agents may go onto the Carlsbad Project or other CEHMM property to locate and take possession of the Tangible Personal Property. CHEMM shall cooperate with the City as necessary to effectuate the City's right to obtain title to and possession of the Tangible Personal Property.

C. Reimbursement by CEHMM. CEHMM shall pay to the City the Residual Value of the Tangible Personal Property not recovered by the City pursuant to Paragraph 10(B), above, and all costs, fees and expenses incurred by or on behalf of the City.

D. Lien. The City may enforce its lien against the Tangible Personal Property, CEHMM's equipment, property, improvements, property rights, contracts, and products. Such lien shall be in the amount of the Residual Value of all the Tangible Personal Property as of the date of the Event of Default, and all costs, fees and expenses incurred by or on behalf of the City in performing CEHMM's duty for it and shall be enforced as provided by law.

E. Other Remedies. The City may pursue any other remedy available by law or equity. No right or remedy is exclusive of any other provided herein or permitted by law or equity. All such rights and remedies shall be cumulative and may be enforced concurrently or individually.

11. Non-Waiver.

Waiver by the City of any material breach in the performance by CEHMM of any of the terms or conditions contained in the Agreement shall not be deemed a continuing waiver of the default or any subsequent default.

12. Survival.
All covenants, agreements, warranties, representations and remedies provided herein shall survive the termination of this Agreement for a period of one (1) year.

13. Assignment of Agreement.
CEHMM shall not sublease, assign, transfer, or permit the assignment or transfer of this Agreement or any interest in or right hereinunder without the prior written consent of the Governing Body given at a duly noticed public meeting. The Governing Body shall not unreasonably withhold its consent. In the event of such assignment or transfer, the assignee shall assume the obligations and liabilities of CEHMM, but such assumption shall not relieve CEHMM of its obligations and liabilities under this Agreement. Further, CEHMM knows and understands that any sublease, assignment, or transfer must conform to all applicable requirements of the Economic Development Plan Ordinance.

14. Successors and Assigns.
This Agreement shall inure to the benefit of and be binding upon the successors and permitted assigns of the parties hereto.

15. Notices.
All notices or other communications permitted or that are required by the terms of this Agreement shall be in writing and be deemed to have been duly given and delivered if sent by certified U. S. mail with return receipt requested with postage prepaid:

if to the City: City of Carlsbad
C/o City Administrator
P.O. Box 1569
Carlsbad NM 88221-1569

if to CEHMM: Center of Excellence for Hazardous Materials Management
C/o Executive Director.
505 N. Main Street.
Carlsbad, NM 88220

Any change of address for any party shall be by notice given to the other parties in the same manner as specified for giving notices.

16. Entirety of Agreement and Modification.
This instrument as written incorporates all the agreement, covenants, and understandings between the parties hereto concerning the subject matter hereof, and all such agreements, covenants, and understandings have been merged into this written Agreement. No prior or contemporaneous agreement, covenant, or understanding, verbal or otherwise, of the parties or their agents shall be valid or enforceable unless embodied in this Agreement. The parties expressly waive any other or further representation, warranty, or agreement

not set forth in this document. Neither this Agreement nor any provisions hereof may be waived, modified, amended, discharged or terminated except by an instrument in writing executed with the same formality as with this Agreement and then only to the extent set forth in such instrument.

17. Arbitration.

Should any dispute arise between the Parties in connection with this Agreement and if such dispute cannot be resolved by discussion between the Parties, the Parties agree to submit the unresolved dispute to binding arbitration in lieu of litigation.

18. New Mexico Law and Venue.

The Parties agree this Agreement shall be construed and controlled by the laws of the State of New Mexico. The Parties further agree that should any legal actions arise out of this Agreement, such action shall be brought in the District Court of Eddy County, New Mexico, for the 5th Judicial District. The Parties expressly consent to both *in personam* and subject matter jurisdiction of the Eddy County District Court and agree that venue shall properly lie in the Eddy County, New Mexico District Court.

19. Waiver of Jury Trial.

The Parties hereby waive the right to a jury trial on any issue arising out of or relating directly or indirectly to this Agreement or the transactions contemplated hereby.

20. Savings Clause.

If any term, clause or provision of this Agreement or the application thereof to any persons or circumstances shall to any extent be illegal, invalid or unenforceable under present or future laws effective during the terms of this Agreement, then it is the intention of the Parties hereto that the remainder of this Agreement or the application of such term, clause or provision to persons or circumstances other than those to which it is held illegal, invalid or unenforceable shall not be effected thereby and its applicability to persons or circumstances other than those to which it is held illegal, invalid or unenforceable shall not be effected thereby. It is also the intention of the Parties hereto that in lieu of such term, clause or provision that is illegal, invalid or unenforceable there be added as a part of this Agreement a term, clause or provision as similar in terms to such illegal, invalid or unenforceable term, clause or provision as may be possible so that said provision will be or become legal, valid and enforceable.

21. Captions.

The captions of any articles, paragraphs or sections hereof are made for convenience only and shall not control or affect the meaning or construction of any of the provisions thereof.

22. Exhibits.

Any instrument or document made and attached to this Agreement shall constitute a part

hereof as those set forth in full in the body of this Agreement whether made a part hereof by reference or whether made a part hereof by attachment.

Signed this _____ day of _____, 2012.

CITY OF CARLSBAD:

_____
DALE JANWAY, Mayor

ATTEST:

_____
City Clerk

CENTER OF EXCELLENCE FOR
HAZARDOUS MATERIALS MANAGEMENT

_____
JOHN HEATON, Chairman of the Board

State of New Mexico)
) ss.
County of Eddy)

The foregoing instrument was signed and acknowledged before me this _____ day of _____, 2012, by John Heaton, Chairman of the Board of the Center of Excellence for Hazardous Materials Management.

_____
Notary Public

My Commission Expires:

_____

CEHMM LEDA Application
Attachment 3.c.

10

CEHMM Algae Business Plan

10

Exhibit 1

Table of Contents

1.0 Executive Summary

1.1 Background: Continued escalation of oil prices has stimulated a national agenda to search for alternative fuel sources. Land-based crops such as corn, canola and soybeans have historically dominated this arena. During the 1990s, however, research conducted by the National Renewable Energy Lab or NREL demonstrated that micro-algae far surpassed the potential for alternative fuels. This endeavor was short-lived however, losing federal funding in lieu of more popular hydrogen programs. Findings from this study, titled "The National Aquatic Species Program", were closely scrutinized and ultimately used as the foundation for resurgence of interest in micro-algal crops. Although micro-algae does far exceed traditional land based crops, from an energy potential standpoint, producing more than 5,000 gallons per acre in comparison to 180 gallons per acre for the best canola, enterprising individuals have recently discovered that fuel may well be one of the least valuable products algal based crops have available. Nutraceutical and nutritional properties of algae, both for people and livestock, were first explored as by-products of algal production. However, they now represent significant product potential with diverse and prolific markets making sustainable profitability attainable in the very near term. This market opportunity would be in addition to the biofuel potential.

1.2 Current Status: The majority of research into efficient algal-oil production is being conducted in the private sector. Most of the high profile and well-funded algae-to-fuel ventures have limited their scope to fuel production and are struggling to justify their economic models. Their approaches are based on bioengineering of algae in a research environment and their results are only lab-scale. Producing non-fuel algae-derived products offers opportunities to accelerate profitability while generating financial resources to achieve cost-effective biofuel production capability over time and as the enabling technologies mature. This alternative product mix and sequencing strategy is fundamental to the core business model CEHMM will pursue.

1.3 The Opportunity: CEHMM intends to generate superior economic and socio-environmental returns for all of its stakeholders. CEHMM will accomplish this using its advanced and proprietary agricultural expertise that will maximize and optimize the value of micro-algae's unique ability to produce aquaculture/animal nutritional supplements, specialty oil products for human application and wellness as well as biodiesel energy. It will accomplish this

on a climate-neutral basis. This vision and commitment combined with the company's track record of success, beyond the laboratory, are the cornerstones of CEHMM purpose on which it will build a global business.

CEHMM will deploy its existing, proven field experience, know-how, science and technologies to build, own and operate commercial scale facilities that produce 1) aquaculture/animal nutritional supplements; 2) high value, premium margin specialty oils; and ultimately 3) bio-crude for diesel/aviation fuel.

To achieve its market leadership and geographic expansion goals CEHMM will also pursue opportunities to license its proprietary intellectual properties and systems to partner with third party sources interested in joint ownership and operation.

2.0 Objectives

Over the next five years CEHMM plans to construct production facilities in multiple geographies, on a global basis, that produce an identified suite of co-products. CEHMM primary objectives over the next two years include:

- Construction of the first 1,200 acre commercial facility.
- Begin production of aquaculture/animal nutritional supplements and specialty oil supplements.
- Establish a broad, reliable customer base to purchase 100% of end products.
- Develop and manufacture self-sustainable systems consistently producing 5,800 gallons of algae oil per acre-feet of water to be converted to feedstock for aquaculture feed, high value oils and biodiesel/aviation fuel.
- Achieve at least a 50 percent reduction in greenhouse gas emissions by converting to renewable energy sources for power including wind, solar, and hydrogen power.
- Employ ongoing research to refine and develop technologies that will further optimize algae production by improving systems that increase production and reduce dependence on outside energy sources.
- Complete plans for second commercial facility.

2.1 Mission: The CEHMM mission is to achieve world leadership in the algae-to-products market as measured by maximizing product revenue and profit per acre-foot of water and achieving an optimum energy lifecycle.

2.2 Keys to Success and Success Indicators: Algae-to-biofuel is an emerging industry with several companies vying for market leadership positions. CEHMM possesses a unique combination of agriculture-focused hands on field experience, technical know-how, proven management leadership and the capability to produce a suite of diversified algae-derived products. These factors are critical to the **Company's readiness to launch the industry's first, commercial-scale facility.** CEHMM's measures of success for the first 24 months of operations include:

- Construct 1,200 acre facility.
- Execute a seamless transition from construction to production.
- Obtain LOIs, MOUs and/or off-take contracts to purchase 100% of aquaculture/animal nutrition supplement production capacity.
- Commit to on-going research, along with constant production monitoring, to improve end product quality and reduced production cost.
- Produce and commence sales of premium priced, specialty oils and biofuel.
- Achieve profitability.

3.0 Company Overview

The company has successfully developed and proven a proprietary and integrated system for cultivating and harvesting wild strain algae that delivers high lipid, protein and EPA content along with state-of-the-art extraction capability to produce aquaculture, animal nutritional supplements, specialty products for human consumption and wellness and biofuel/aviation energy. The Center of Excellence for Hazardous Material Management (CEHMM) is a 501(c)(3) research and development organization established in May 2004. This organization is funded with grants awarded by the U.S. Department of Energy and the State of New Mexico. The leadership team of the CEHMM algae project has been in place since 2005 and has established a proven track record of success.

CEHMM is presently operating a research and development facility in Artesia, NM. This facility includes laboratory facilities, offices, five raceway ponds and one of a kind, state-of-the-art oil extraction plant. CEHMM is headquartered in Carlsbad, NM.

3.1 Company Ownership: CEHMM is a 501(c)(3) New Mexico Corporation.

3.2 Start-up Strategy: CEHMM's primary financial objective is to achieve early and sustainable profitability. To that end all business decisions will be evaluated and measured based on these criteria. The first strategic initiative is to produce products for which there is a current market demand and that can be manufactured at commercial scale. The second objective is to position these products in a

manner that differentiates them from others by emphasizing their unique advantages and branding them to create customer loyalty and command premium pricing and maximum ROI.

3.3 Company Locations and Facilities: CEHMM will initially operate in two locations:

- Headquarters in Carlsbad, NM and R&D in Artesia, NM. Leases and infrastructure are already in place at these locations.
- The Company's first commercial scale production facility will be in southwestern US on land that has been identified as ideal for CEHMM's operations.
- This geographic area provides properties with minimal site development and is available on very attractive economic terms.

3.4 Production Site Criteria: The ideal site criteria world-wide includes:

- Non-arable land with little geographic relief (preferably flat).
- Non-competitive with existing land based agriculture.
- Adequate water resources, preferably sea water salinity. Water depth should be <500 ft bgs (below ground surface) to minimize pumping costs.
- Maximum sunlight with warm temperatures, preferably in environs with >200 frost free days annually (either desert or other temperate climates).

4.0 Products Summary

CEHMM will focus on producing four main products. These include: 1) fish meal for commercial aquaculture farming, 2) ruminant animal feed, 3) high value oils used as ingredients for neutraceuticals and human nutrition, 4) biofuel/aviation jet fuel. Additionally, the Company is committed to expanding its initial product line by creating new algae-derived products that qualify as bio-preferred products according to the USDA and are eligible for certain subsidies. This will be accomplished through close collaboration among CEHMM's Research & Development, Marketing and Business Development teams in concert with the USDA.

4.1 Product Descriptions and Market Demand: Each of the CEHMM product categories will address a distinct, targeted market that are expected to result in long-term off-take agreements with customers that are geographically proximate to its production facilities.

To date CEHMM has produced biomass from algae that, according to third party laboratory tests, exceeds aquaculture industry standard feeds for omega-3 fatty acids and protein content. CEHMM will produce this biomass at commercial scale and sell it as raw material for the production of premium

feedstock to the aquaculture industry. Prevailing demand for this feedstock is a huge global market and growing YOY.

The second product category is ruminant animal feed. CEHMM has had extensive testing conducted by third parties to determine the viability of the biomass as a high-end nutritional supplement for the cattle industry. The results have shown that CEHMM biomass provides a superior substitute for the current high-end cattle feed sources. To date the efforts have paid off in an off-take letter of intent from two of the nation's largest cattle feeders for the biomass CEHMM can produce. This market is so large that demand would far exceed CEHMM's production capacity. There is an immediate need for this product in close geographic proximity to the proposed commercial site and will be easily marketed and transported to the end users.

The third product category is high value specialty oils, which will target a broad market segment including the neutraceuticals and pharmaceutical industries.

The fourth product, bio-crude, is presently in high demand. Geo-political forces, global energy market dynamics, climate change initiatives, sovereign government policy favoring oil independence and government mandates for renewable fuels create a worldwide biofuels market that provides unlimited potential. CEHMM target markets will include state and federal agencies, refineries, mines and the U.S. military that are located within a 300 mile radius of it production sites.

4.2 Competitive Differentiation: CEHMM diversified and profit-generating co-products are what differentiate it from other algae to biofuels companies who depend on biofuel as their sole and/or primary source of revenue.

CEHMM has focused on developing the most economically viable, integrated business model by utilizing virtually 100% of its algae production capacity to produce four main products for existing, well-established end user markets. The Company achieves near zero waste, which reduces costs and increases profitability. This capital and cost efficient strategy is often discussed but rarely implemented among companies in the industry many of whom, due to specific investor requirements, are limited to producing only biofuel. This multiple product suite strategy also provides business flexibility and mitigates the risk of category and customer concentration.

The factors below underscore CEHMM's ability to achieve a strong leadership position in the emerging algae biomass industry.

- Proven, qualified management team
- Applied and field-proven algae farming science and techniques
- Field-proven cultivation, harvesting and predation control techniques
- Consistent production of high lipid content algae (40%+)

- Consistent protein content of >50%
- EPA content of 17%
- Diversified product line including aquaculture and ruminant nutritional supplement, high-value oils and bio-crude
- Fully integrated, start-to-finish process
- Best of breed partners (e.g., "wet extraction")
- Virtually unlimited sunlight, land and water resources
- Natural, wild strain algae (no GMO)
- Profitable economic model built on diversified revenue streams without government subsidies or projected crude oil price increases
- Standardized measurements and protocols
- Well controlled and efficient operations

CEHMM will also differentiate itself by being the first to market, with a commercial scale operation.

4.3 Facility Site Selection: Determination of key success criteria and undertaking a thorough search for qualified primary and back-up sites has resulted in the selection of CEHMM's first commercial site in southwestern US. The site has flat land, ample water, sunlight and existing utility infrastructure all of which combine to reduce CEHMM's initial capital costs. The 1,200-acre facility will accommodate 144 (6 acres each) ponds. Once the first 100 acres of ponds are complete, CEHMM will launch the initial transition to commercial operations.

4.4 Technology: Proprietary information/intellectual property and the CEHMM "out of the lab into the field" agriculture-based operating approach has provided CEHMM with experience and resulted in unprecedented success that no other company has achieved to date. The Company owns the following proprietary information, intellectual property and know-how:

- Crop protection
- Growth boost procedure
- Cultivation (paddle wheel design, aeration techniques)
- Water movement
- Data collected from the algae ponds
- Harvesting
- Lipid increase techniques
- Nutrient composition
- pH manipulation
- Feed regimes
- Oil extraction
- Thin layer chromatography methodology
- Pond management/amortization

The CEHMM proprietary growth system includes significant historical data that supports the growth rates, lipid, protein, EPA content and harvest rates, which are incorporated in its operating and financial projections. The process entails growing wild strain, marine-based algae in naturally-occurring, available and otherwise unusable brine water on non-arable desert land. This results in zero impact on land and water used for food production.

4.5 Future Products: In conjunction with the USDA's 2008 Farm Bill, the USDA has developed a list of bio-based products that enable producers to qualify for crop establishment and land use subsidies. CEHMM is exploring the opportunities under the department's bio-preferred program to develop eligible algae-based bio-preferred products.

5.0 Market Analysis Summary

The immediate markets for CEHMM products are broad and varied. Listed below is a representative list of target markets for CEHMM products.

Aquaculture Nutritional Supplements:
Aquaculture economists have noted that current domestic consumption of commercial fish food exceeds domestic production requiring the "supply gap" to be filled by imports, mainly from Chili. The recent Gulf oil crisis has caused a significant reduction in the of supply fish used to manufacture fishmeal, with no estimate for recovery. This is causing higher retail prices. Commercial fish production can fill the gap but only if new food supply is created at competitive prices.

CEHMM has commissioned third party testing of its algae biomass to evaluate its nutritional content. The results exceed industry standards for omega-3 fatty acids and protein. These product characteristics are highly valued by the aquaculture industry for their contributions to product quality and market value of fish feed. Next stage field-testing of digestibility and palatability on different species of commercially grown fish is being pursued. Once field testing is completed it is estimated that commercial production can be achieved within 60 – 90 days of funding.

Ruminant Nutritional Supplements:
CEHMM has had extensive testing conducted by third parties to determine the viability of the biomass as a high-end feedstock for the cattle industry. The results have shown that CEHMM biomass would make a superior substitute for the current high-end cattle feeds. To date the efforts have paid off in an oft-take letter of intent from DuckSmith Farms for the biomass CEHMM can produce. This market demand far exceeds projected CEHMM production capacity. There is an immediate need

for this product in close proximity to the proposed commercial site and will be easily marketed and transported to the end users.

High Value Oils:
High value omega-3 oils will comprise 3.5 -10% of the total biomass production and will be separated out and sold to the nutraceuticals and pharmaceuticals industries. In 2009, global consulting firm Euromonitor reported the increasingly favorable regulatory environment towards omega-3s, especially in the US and Australia. "It is expected that recommended daily intake levels for long-chain omega-3s will soon be established by official and government institutions," says Euromonitor industry ingredient manager John Madden. "Next to probiotics, omega-3 is the hottest functional ingredient right now and it is successful in both dietary supplements and fortified/functional products." "With so many sectors still underdeveloped and completely untapped, we predict the market size could double to $3bn over the next five years. The industry agrees that the currently comparatively small area of food and beverages provides the best growth opportunities," he adds.

Biofuel:

- U.S. military (There are mandates in place for the use of a renewable biofuel if available.)
- Mining industry (The emissions from a true biodiesel are much less hazardous than a green diesel or petroleum diesel.)
- State governments (Numerous states have mandates in place to use a renewable biofuel if available.)
- Transportation fuel producers

The biofuels market will help have a major contribution to moving the United States away from foreign oil dependence but also will provide a more environmentally friendly fuel with numerous advantages over conventional fuel.

Recent uncertainty and disruptions in Middle East oil production and the oil spill crisis in the Gulf of Mexico further underscores the critical need to seek out alternative fuel sources for future green energy initiatives.

5.1 Market Segmentation: CEHMM will target high volume users for all four product categories. The identified targets will be cultivated in an effort to establish off-take agreements that represent up to 100% of CEHMM's production capacity while simultaneously planning for the next phase/plant knowing that the market demand is sufficient to absorb the increased production as it comes on line.

5.2 Target Market Segment Strategy: CEHMM will focus its marketing effort on engaging large volume purchasers of its product, in long-term off-take agreements. Ideally CEHMM would contract with several customers for each main product to ensure a steady revenue stream while mitigating customer concentration and maximizing cost efficiencies. .

5.2.1 *Market Needs*: CEHMM aquaculture feed meets the performance requirements of its buyers based on its high omega-3 fatty acid and protein content as well as overall superior quality and performance results. Initial interest from fishmeal producers indicates demand of up to 100% of year one of CEHMM's production capacity.

CEHMM ruminant nutritional supplement: To date the efforts have resulted in an oft-take letter of intent from two major beef producers for the biomass CEHMM can produce. The market demand far exceeds projected CEHMM production capacity. There is an immediate need for this product in close proximity to the proposed commercial site and will be easily marketed and transported to the end users.

CEHMM high value oils meet the product specifications of the neutraceuticals and human nutrition products manufacturers. A recent study from the Harvard School of Public Health found that diets deficient in omega-3 cause up to 96,000 deaths a year in the US. Such deficiency, according to the study, ranked sixth highest among killers of Americans, exceeding even high trans fat intake. Worldwide demand for omega-3 oils is estimated at US$1.5 billion in 2009, has been growing annually by 25+% and is expected to double to US$3.0 billion by 2014.

CEHMM Biofuel target customers have two immediate needs that are satisfied by CEHMM biomass production:

- Meets the renewable fuel mandates legislated by state and federal governments
- Meets clean air standards legislated by state and federal governments

5.2.2 *Market Trends*

- End product consumption includes aquaculture/animal nutritional supplements, neutraceuticals/cosmetics and transportation fuel.
- Aquaculture feed and high value oils are estimated to generate significantly higher margins per barrel versus biofuel (Biofuel = $90/Barrel versus $700/Gallon for high value oil).
- Government mandates and financial support initiatives include:
  - 5% biodiesel blends by 2012 in NM
  - Fed stimulus funding
  - Tax credits (extension for blenders)
  - Tax incentives (up to 30% tax investment tax credit, Bill S.3338)
- Private investment*
  - Total $$$ invested in cleantech by VC exceeded all non-cleantech in 2008

* Source: PriceWaterhouseCoopers

- Alternative fuels accounted for 18% of all cleantech investing in Q1 2009 (ahead of solar, transportation, energy storage and wind/geothermal)
- Representative "Big Oil" participation in algae-to-biofuel including Exxon, Valero, Cargill, BP
- Global interest
  - Sovereign governments are committing land, development rights and supply agreements to promote algal projects.

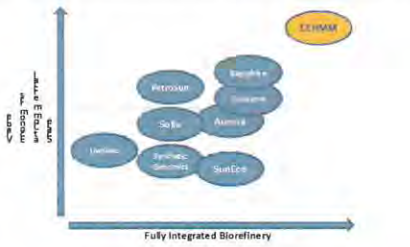
The motivations include energy security, economic development and fresh water production by powering desalinization plants, et al.

The current market for biofuels is stimulating rapid transition away from ethanol produced from food crops to biofuels produced from renewable, environmentally and economically sustainable non-edible biomass. CEHMM is well positioned to capitalize on this shift and build the first commercial scale, algae to aquaculture and ruminant nutritional supplement, high value oil and biofuel production facility. The fossil fuel economy has created a global infrastructure that can be leveraged by "drop-in fuels" such as algae-derived biofuel. The production of renewable fuels is essential to achieving energy independence sought by the U.S. and an increasing number of sovereign nations. CEHMM intends to be a leader in the emerging, renewable fuels market for years to come.

5.2.3 *Market Growth: CEHMM* views the biomass markets as unlimited and plans to add customers to its base as production capacity increases. CEHMM also sees its aquaculture/animal nutritional supplement demand far exceeding supply. CEHMM's aquaculture/animal nutritional supplement and biofuel products will, over time, reduce reliance on food crops that are presently being allocated to supply these industries.

5.3 Industry Analysis and Competition: The alga to biofuels category is an emerging industry. Sustained high crude oil prices, climate change debate, government clean energy programs and the over-dependence of 1st and 2nd generation biofuels on edible feedstocks have put the spotlight on algae as a promising alternative source of biofuel for transportation and military aviation. Entrepreneurs and investors are actively pursuing the algae opportunity and today there are many companies using advanced science and bioengineering technology to achieve biofuel production from algae on an economically-viable commercial-level and/or to create tools to assist the production process.

CEHMM's Unique Position



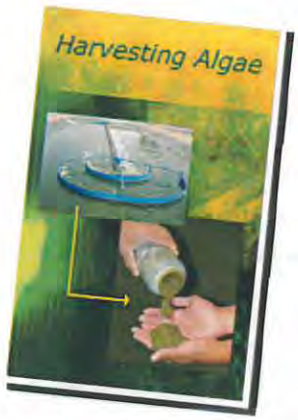
Industry analysts report that there are between 50 and 100 companies pursuing various aspects of the algae-to-products opportunity. At present, none of these companies engaged in biofuel production have produced biofuel from algae on a commercial scale and all but a very few have produced end products outside the laboratory.

CEHMM will be the first to achieve commercial scale production in this emerging industry.

Below is a list of several key challenges/problems confronting the industry.

- Lab-scale syndrome
- Low or inconsistent lipid quality and content
- Limited understanding of byproduct(s) and their value
- Inability or unwillingness to integrate science, engineering, and farming ("algronomy")
- Multi-phase process to produce biofuel
- No process integration
- Insufficient sunlight, land, and water
- GMO stigma
- Economics don't work
- Lack of standardization of units of measurement

5.3.1 *Industry Participants:* Due to the significant capital cost of entry and the economics of scale, this emerging industry is seen as one that will be ultimately dominated by a small number of companies. Currently there are no algae to biofuels plants in production. There are several companies making plans to enter this market in the next 2-3 years. (See Exhibit I – Competitive Matrix)



5.3.2 *Distribution Patterns:* CEHMM will have direct sales to large users of each of its product. CEHMM has initially identified a 300-mile radius to market its biomass products to reduce transportation cost. CEHMM will market its products through its own sales force.

5.3.3 *Competition and Differentiation:* Evaluation of the many industry participants is a complex process that requires understanding of the key success factors. CEHMM believes that successful companies in this industry need to possess the following attributes:

- Management and technical expertise

- Optimum growing environment: including ample sunlight with direct access to a water supply and land
- Agricultural expertise and experience: wild Algae strain identification, growing, predation management and harvesting technique
- Sufficient working capital and cost efficient: growing environment, plant design and construction and ongoing operations at a commercial level
- Favorable energy life cycle/energy balance
- High lipid content algae strains
- High protein biomass
- Robust revenue streams from co-products: to ensure financial success and risk mitigation

Exhibit I contains a list of the most prominent industry players and their summary profiles. The markets for algae-based products such as, animal/aquaculture nutrition supplements, specialty chemicals, and biofuel etc. are global and represent multi-billion dollars in annual sales. Like the industries that serve these huge markets today, the algae-based products industry will accommodate the participation and success of multiple companies.

To date, CEHMM is one of the very few companies, if not the only, to successfully conduct extensive field testing and build a fully integrated, algae-to-oil, production facility. CEHMM has achieved this leadership position by balancing laboratory and field operations with the goal of establishing commercial scale operations in a compressed timeframe. Additionally, and unlike many of the industry participants, CEHMM possesses agricultural know-how that, in conjunction with its science and engineering resources, has enabled CEHMM to successfully integrate the key components of research, growing, harvesting and extracting oil from algae.

Importantly, CEHMM has also identified potential of high-value co-products and has conducted third party testing to determine their suitability for sale in existing markets as well as establishing their realistic market value. Our conclusion is that CEHMM co-products will yield early and significant revenue and profits and will mitigate the risk of dependency on biofuel as the primary source of revenue.

6.0 Strategy and Implementation Summary

6.1 Competitive Advantages: CEHMM's first to commercial scale production will provide it with a major advantage. This position will allow CEHMM to secure long-term off-take agreements with leading end users and establish CEHMM's incumbency relative to competitive latecomers. CEHMM's proprietary, field-proven know how related to crop protection and feeding regimes will ensure CEHMM's ability to supply products that meet required quantity and quality parameters, critical customer satisfaction factors that differentiate CEHMM from the competition.

6.2 Marketing Plan:

6.2.1 *Overview:* As in most industries and business categories, corporate identity and brand awareness is the "backbone" of success. Companies spend millions of dollars to establish and maintain their branding in the market place. Coca Cola, Chevrolet, Microsoft and General Electric are just a few examples of this marketing strategy. The ability to establish this presence and build on the equity it provides can dictate a brand's rising star status or its demise.

As competitive products enter the marketplace CEHMM brand recognition among processors and end users will become an important success factor. The CEHMM marketing plan supports the long-term goals of CEHMM to be the premier, leading source of algae-derived aquaculture and ruminant nutritional supplements, high value oils and biofuel. Once its operations and branding strategy are established CEHMM plans to explore franchising opportunities.

6.2.2 *Objective:* Create a branding strategy that generates the same "global awareness" for the CEHMM brands as the "H1N1 – Swine Flu" accomplished in 2010.

6.2.3 *Strategy:*

- Develop a corporate identity plan that links all end products with CEHMM.
- Create specific brand names for each of the sub-product categories and individual products that reflect the CEHMM corporate image and attributes i.e. high quality, algal farming roots; comprehensive, ongoing research based; etc.

- Utilize relevant internet and social media channels to establish branding and promote the benefits of CEHMM green technology.
- Develop a comprehensive public relations campaign to educate target audiences including end users of the benefits of supporting CEHMM green technology products.
- Participate in trade show and other forums that promote the development and use of alternative energy technology.
- Sponsor educational grants and scholarships at primary and secondary educational levels targeting research and development of green technology.
- Deploy marketing resources as direct contact tactics with all target audiences including prospective franchise owners.

6.2.4 *Target Audience Positioning:* Offer a highly productive algae-derived products manufacturing system that can be licensed, manufactured and installed to deliver a production capacity that augments or replaces a significant portion of the aquaculture and ruminant nutrition supplements, high value oil and petroleum-based transportation fuel needs of the world.

6.2.4.1 Target Audience Categories

- Primary End Users
  - Commercial aquaculture facilities
  - Animal feed supplements
  - Biomass for Ethanol production
  - Cosmetics, Health supplements
- Secondary End Users
  - Oil corporations
  - Government structures (military, city and state backup systems)
  - Independent distributors
  - Agriculture, transport (road, rail, sea, air) high-grade oil user
- Prospective Franchise Holders
  - United States
  - Western Hemisphere
  - Europe/Asia

6.2.5 *Pricing Strategy: CEHMM* expects pricing to be driven by current markets plus any premium that CEHMM can justify based on superior product attributes and branding. The biofuels will be driven by the price of a barrel of biocrude and a gallon of gasoline/diesel fuel. This price will fluctuate, but for sales and economic forecasting a base of $80 dollars a barrel is used. The aquaculture and ruminant feed markets will be driven by current market prices plus premiums for nutritional value that

exceeds industry standards. For its financial projections, CEHMM assumed $1,100 per ton.

For high value oils, CEHMM will be separating out the EPA contained in the species grown. Current market value for EPA is $750 per gallon and up. CEHMM used $700 per gallon for the economic forecast in months 25-47 and adjusted it down to $600 per gallon for months 48-60. CEHMM only used 3.5% of total oil volume as the content for EPA in the economic model. This was done as a conservative measure in the model. To date independent testing has shown that CEHMM consistently has 17-21% EPA in its algae. The potential to produce more EPA and generate increased revenues is extremely high.

6.2.6 *Distribution Strategy:* CEHMM sees its targeted commercial location as suitable to reach a large number of customers for its various products. Aquaculture/ruminant nutritional products and high value oils will have a national distribution. CEHMM has targeted a 300-mile radius as ideal initially to sell and distribute its biofuel products. CEHMM projects its ability to sell 100% of production capacity and simultaneously minimize distribution costs.

6.3 Sales Strategy: CEHMM will sell directly to companies within the business categories it has identified as primary targets (see Section 6.2.4 for details).

6.3.1 *Sales Forecast:* Construction and plant start-up will take approximately two years to complete. CEHMM projects to have its aquaculture nutritional products ready to sell within 60 – 90 days of construction start. As soon as a pond is complete CEHMM will bring that pond on line. Fuel and high value oils will be online between 18-24 months.

6.4 Milestones:

Milestone	***Timing***
Phase 1: Site acquisition and preparation	Month 1
Phase 2: Construction of infrastructure first 100 acres	Month 4
Phase 3: Revenue generation from first 100 acres	Month 6
Phase 4: Build out of remaining 900 acres	Month 24
Phase 5: Revenue generation from additional acreage	As it comes online

7.0 Management Team

CEHMM's founders will comprise the senior leadership team and have been operating the business since 2005. They are responsible for the development of the company's IP and integrated biorefinery in Artesia, New Mexico. With the spin-

off from the predecessor organization, CEHMM will hire seven additional personnel to complement the eight employees who are trained and knowledgeable in the current operations of the company thereby providing the company with an immediate and solid base of trained employees to build on. CEHMM expects to increase headcount as it ramps up operations. It will be very selective in its hiring practices and develop training and orientation programs to accelerate the productivity of new hires.

7.1 Organizational Structure: See Exhibit II for Organization Chart

7.2 Leadership Team Biographical Sketches: The management team includes the following individuals:

Mr. Douglas C. Lynn has served as Executive Director of CEHMM since 2006. He originated the applied research component of the algae biofuels project and several other flagship projects. His experience includes more than 15 years experience in NEPA and radiological environmental sampling and the various disciplines of land management and 25 years experience in various agricultural disciplines, most notably farming, livestock operations, and aviculture. He is a certified realty specialist with more than 15 years experience in private, state and federal property management. He established a reputation for the ability to integrate multiple disciplines (e.g. agronomy, oil and gas) into successful enterprises. During a 12-year tenure as a public school instructor, he was the recipient of state and national recognition for teaching excellence. In addition to a Bachelor of Science degree from Sul Ross State University, Mr. Lynn amassed postgraduate education hours from New Mexico State University, Brigham Young University, Eastern New Mexico University, and Oak Ridge Associated Universities in the fields of wildlife biology and environmental science. He chaired the Board of Directors for the Carlsbad Caverns/Guadalupe Mountain Association for five years and served as the State Director for Quail Unlimited for three years. He has more than 13 professional certifications that include realty, RCRA, safety, data quality, environmental assessments, radiological surveillance, and certification as a Level I Petroleum Technician.

Mr. Gregory W. Brown has served as Business Manager for the Center of Excellence for Hazardous Materials Management since 2005. He received his BBA in Finance from Texas Tech University and his MBA from Eastern New Mexico University. In addition to his duties at CEHMM, he owns PulseAir Medical Equipment in Carlsbad. He has over 10 years experience as a small business owner and 10 years budgeting experience working for a Department of Energy Managing and Operating Contractor. He also serves on the board of directors for Financial Security Credit Union.

Mr. William Foster is currently Environmental Scientist for the Center of Excellence for Hazardous Materials Management responsible for the laboratory

activities related to monitoring of physical and chemical parameters of algae culture medium, developing the system for cultivation of microalgae for use as a feedstock for biodiesel production and techniques for increasing algae productivity and lipid content. He has a Bachelor's degree in Aquatic Biology/Fisheries Science from New Mexico State University. He has extensive experience in ground water monitoring, ecological monitoring of aquatic and terrestrial environments, construction, land and construction survey, heavy equipment operation, soil and concrete testing, landscaping and irrigation contracting. He also has extensive training in the design and installation of photovoltaic systems, which can be incorporated into the design of an algae/biofuel operation to reduce the long-term energy costs.

7.3 Personnel Plan: CEHMM will start with 15 personnel and will build to 55 personnel by the end of the second year. The hiring plan is included in the attached pro forma. It is broken down by month and type of personnel.

8.0 Financial Plan

The complete, detailed five-year proforma is attached as a separate excel file. The proforma was assembled through the use of real data that was formulated, collected and verified over four years and was a collaboration between CEHMM/CEHMM, NMSU, and Texas A&M. A Ph.D. economist from NMSU, a Ph.D. agriculture economist from Texas A&M, and CEHMM assembled the proforma with the most current and best data the industry has to offer.

8.1 Start-up Funding – 48 Months: The proforma was formulated for a 1,200-acre parcel of land with 144 ponds containing 6 acre feet of water/pond. The project will take $88,860,000 dollars if completely built within two years.

Budget for 1200 Acre Facility

Construction - Ponds	Costs	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Total
R&D Facility	$700,000	$700,000								$700,000
Permitting	$80,000	$80,000								$80,000
Engineering Design	$500,000	$500,000								$500,000
Ponds (1400 ponds earth work)	$30,800,000		$4,410,000	$4,410,000	$4,410,000	$4,410,000	$4,410,000	$4,410,000	$4,340,000	$30,800,000
Ponds (1400 ponds liner work)	$1,400,000		$201,000	$201,000	$201,000	$201,000	$201,000	$201,000	$194,000	$1,400,000
Paddle Wheels (1400 paddle wheels)	$3,500,000		$3,000,000	$500,000						$3,500,000
Turning Vanes (2800 turning vanes)	$700,000		$700,000							$700,000
Islands (1400 Islands)	$1,400,000		$1,400,000							$1,400,000
Air Equipment (1400 ponds)	$980,000		$980,000							$980,000
Sensors (1400 ponds)	$420,000		$420,000							$420,000
Land (1400 acres)	$950,000	$950,000								$950,000
Security	$90,000				$15,000		$15,000	$15,000	$45,000	$90,000
Piping and Fittings	$840,000		$420,000			$420,000				$840,000
Total	**$42,360,000**	**$2,230,000**	**$11,531,000**	**$5,111,000**	**$4,626,000**	**$5,031,000**	**$4,626,000**	**$4,626,000**	**$4,579,000**	**$42,360,000**

Extraction and Harvesting	Costs	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Total
Extraction	$25,000,000	$3,000,000	$3,000,000	$4,000,000		$9,000,000			$6,000,000	$25,000,000
High Value Oil Separation	$10,000,000	$2,000,000		$2,000,000		$2,000,000			$4,000,000	$10,000,000
Harvesting	$6,000,000			$4,000,000	$2,000,000					$6,000,000
Lab and Equipment	$2,000,000		$2,000,000							$2,000,000
Buildings	$2,000,000	$2,000,000								$2,000,000
Support Services/Equipment	$1,000,000	$1,000,000								$1,000,000
Holding Tanks	$500,000				$500,000					$500,000
Total	**$46,500,000**	**$8,000,000**	**$5,000,000**	**$10,000,000**	**$2,500,000**	**$11,000,000**			**$10,000,000**	**$46,500,000**

Total Facility Costs	**$88,860,000**

8.2 Annual Operating Costs – Five Year

Yearly Operating Cost					
Revenues	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Bio Crude			$7,238,095	$7,961,905	$8,758,095
Animal Nutrition Products	$4,945,248	$22,076,010	$17,806,800	$17,806,800	$17,806,800
Jet Fuel Paste	$69,300	$118,800	$118,800	$118,800	$118,800
High Valaue Oils			$94,500,000	$94,500,000	$81,000,000
Total Revenue	**$5,014,548**	**$22,194,810**	**$119,663,695**	**$120,387,505**	**$107,683,695**
Royalty Fees	$3,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
Net Revenue	**$2,014,548**	**$21,194,810**	**$118,663,695**	**$119,387,505**	**$106,683,695**
Operating Costs	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Techs (25 FTEs)	$261,350	$898,550	$1,500,000	$1,500,000	$1,500,000
Maint (10)	$167,500	$415,400	$562,800	$562,800	$562,800
Admin (3 FTEs)	$169,200	$186,600	$204,000	$204,000	$204,000
Mgt (8 FTEs)	$889,200	$934,200	$979,200	$979,200	$979,200
Scientist (7 FTEs)	$225,400	$575,400	$800,400	$800,400	$800,400
Eng (3 FTEs)	$200,400	$275,400	$350,400	$350,400	$350,400
Benefits (Ins/401k/dental/etc)	$573,915	$985,665	$1,319,040	$1,319,040	$1,319,040
Electricity	$80,000	$269,000	$396,000	$396,000	$396,000
Maintenance		$100,000	$370,000	$370,000	$370,000
Overhead & Maint.-General & Admin.	$24,000	$24,000	$24,000	$24,000	$24,000
Prop. And Liability Ins.	$18,000	$18,000	$24,000	$24,000	$24,000
Recruiting	$4,500	$5,000			
Travel Exp	$72,000	$72,000	$72,000	$72,000	$72,000
Board of Directors Meeting Expense	$56,000	$56,000	$56,000	$56,000	$56,000
Board of Directors Travel	$12,000	$12,000	$12,000	$12,000	$12,000
Franchise Development	$2,000	$24,000	$24,000		
Telephone/Internet	$14,400	$14,400	$30,000	$30,000	$30,000
Rent	$30,000	$30,000	$30,000	$30,000	$30,000
Fractionation and Separation			$2,604,000	$2,604,000	$2,604,000
Agriculture Inputs	$42,300	$174,840	$236,880	$236,880	$236,880
Total Yearly Costs	**$2,842,165**	**$5,070,455**	**$9,594,720**	**$9,570,720**	**$9,570,720**

8.3 Important assumptions: The following are the parameters/assumptions to build the model:

- Each pond will contain six acre feet of water
- 3.8 million gallons of oil will be produced per year for fuel production
- 135,000 gallons of high value oil will be produced per year
- 16,200 tons of animal feed produced per year
- Pond density of 1 gram per liter*
- Oil content of algae 40%*
- On average half the ponds contents are harvested per week
- Revenue from product will begin in month 6
- Company has developed scenarios for stage build-out in 100 acre increments

*Numbers that CEHMM is consistently maintaining and has for some time now.

8.4 Break-even analysis: The break-even point of the project is month 31. This could be more quickly if CEHMM elects not to use the full $88,000,000 for construction. It is possible that CEHMM would only need $73,000,000 if the early revenue projections were achieved.

For projected profit and losses, projected cash flow and payback, please see the attached proforma.

8.5 Use of Funds

- Capital Equipment - $46,500,000
- Construction - $42,360,000

9.0 Exhibits

Exhibit I – Competitive Matrix

Company	*Founded*	*Owners/Partners*	*Approaches*	*Products*	*Field Operations*	*Fully Integrated*
CEHMM (NM)	2006	• Private • CEHMM/501(c)(3) • State of NM and DOE ($9MM)	• Wild strain • Open pond • Wet extraction	• Biocrude • Animal/ aquatic nutrition & feed • High-value oils	• Yes (NM)	• Yes
Algenol Biofuels (FL/TX/Mexico/Germany) http://www.algenolbiofuels.com		• Private • Valero • DOE grant ($25MM)	• GMO+CO2 • Closed PBRs • "Fuel secretion"	• Ethanol	• Under construction	• Yes
Aquaflow Binomics (New Zealand) http://www.aquaflowgroup.com		• Public • Boeing	• Open pond	• Jet fuel Biofuels • Algae paste • Clean H2O	• ?	• ?
Aurora Biofuels (CA/FL) http://www.aurorabiofuels.com/about-aurora-biofuels.php		• Private • Venture-funded ($40MM)	• GMO • Open pond • Wet extraction	• Biodiesel • Animal feed • Consulting & Mgmt.	• Yes (FL)	• No
Bionavitas (WA) http://www.bionavitas.com/aboutus.html		• Private		• Enhanced algae growth • Low cost health products • Environmental remediation		
Blue Marble Biomaterials (WA) http://bluemarblebio.com	2005	• Private	• Bacteria fermentation	• Specialty chemicals	• No	• No
Carbon Capture (CA) http://www.carbcc.com/22623/22644.html	2005	• Private	• Open pond	• Diesel • Butanol • Biomethane • Jet fuel • Feeds & pigments	• Yes (CA)	
Cellena (HI)		• Private • Shell Oil	• Open pond • Proprietary extraction			
Joule (MA/TX) http://www.jouleunlimited.com	2007	• Private • Venture-funded ($30MM)	• Single cell algae+ GMO+Solar+ CO2 • Closed PBRs • "Fuel secretion"	• Ethanol • Diesel • Chemicals	• No	• Yes
Live Fuels http://www.livefuels.com		• Private • Founders/Angel-funded ($10MM)	• Open pond • Algae-to-fish-to-products	• Renewable oils • Fishmeal • High-value dietary supplements	• No	• No
PetroAlgae (FL) http://www.petroalgae.com		• Public	• Wild strain	• Algal paste • Turnkey algae farms	• Yes (FL)	• No
PetroSun (AZ/TX) http://www.petrosuninc.com/alternative-energy.html		• Public	• Open pond		• Yes	• No
Sapphire Energy (CA/NM) http://www.sapphireenergy.com		• Private • Venture-funded • DOE grant ($50MM) • USDA loan guarantee ($55MM)	• Wild strain • GMO emphasis • Open ponds	• Green crude • Jet fuel • Diesel	• Yes (NM)	• In process

Seambiotic/Inventure Chemical (Israel) http://www.seambiotic.com		• Private • NASA	• Open pond • CO2-enhanced		• Yes (Israel)	• No
Solazyme (CA) http://www.solazyme.com	2003	• Publicly traded • Venture-funded ($76MM) • DOE grant ($20MM)	• Wild & GMO • Fermentation	• Biofuels • Oils for wellness & cosmetics • Human & animal nutrition	• Yes (CA)	• Yes
Solena (Wash DC & Madrid, Spain) http://www.solenagroup.com		• Private	• Algae gasification • Closed PBRs	• BioSynGas	• Announced collaboration w/ British Airways	
Solix Biofuels (CO) http://www.solixbiofuels.com	2006	• Private • Venture-funded • Valero	• Wild strain • Closed PBRs • CO2-enhanced	• Biocrude	• Yes (CO)	• No
Synthetic Genomics (CA) http://www.syntheticgenomics.com		• Private • Venture-funded • Exxon Mobil	• GMO	• Biofuel	• No	
XL Renewables http://www.xlbiorefinery.com		• Private	• Dairy effluent • Semi-closed PBRs	• Biomass • Animal feed • Ethanol • Biodiesel • Proj. Dev. & Oper. Serv.	• Yes (AZ)	

Exhibit II – Organizational Chart

CEHMM LEDA Application
Attachment 4.b.

Assistance Being Requested

The Center of Excellence for Hazardous Materials Management (CEHMM) formally requests conveyance of ownership of the attached list of infrastructure/equipment. The subject equipment/infrastructure is vital to the ongoing, cutting-edge research and development work conducted on the CEHMM algae project. Failure to attain the equipment would result in the culmination of the CEHMM algae project, thus eliminating eight employment positions within the organization. This equipment/infrastructure provides the mechanisms necessary for the research and development to continue. Furthermore, the equipment is vital in CEHMM's intent to incentivize investor inquiry into the genesis of a new and scientifically challenging industry in Carlsbad. Equipment and complimentary infrastructure purchased under the auspices of the Energy Innovation Fund represent a valuable, appealing private investment opportunity for investors and fosters new economic development potential for the area within the new and exciting emerging industry of algal cultivation.

Exhibit 2

CONTRACT/COOPERATIVE AGREEMENT

THIS AGREEMENT is effective as of the 20th day of October, 2010. This Agreement is by and between The Regents of **New Mexico State University,** which has a mailing address of P.O. Box 30002, MSC OGC, Corner of Stewart and Espina Street, Las Cruces, New Mexico 88003-8002 (*hereinafter referred to as "NMSU"*), and the **Center of Excellence for Hazardous Materials Management,** a New Mexico nonprofit corporation, with its principal office and place of business at 505 N. Main St., Carlsbad, New Mexico 88220 (*hereinafter referred to as "CEHMM"*).

WHEREAS, CEHMM is a non-profit corporation engaged in environmental research, and

WHEREAS, CEHMM was originally established to assist with technical aspects of the Waste Isolation Pilot Plant (*hereinafter referred to as "WIPP"*), and

WHEREAS, CEHMM has grown and expanded its scope to address a number of environmentally related issues that are unique to New Mexico, and

WHEREAS, the long-term sustainability of agriculture in the Pecos Valley is dependent upon water and affordable fuel, and

WHEREAS, the need to become more independent of foreign oil and New Mexico's abundance of sunshine has prompted CEHMM to pursue the possibilities of growing algae in a farm setting for the production of oil, and

WHEREAS, CEHMM has had a relationship with NMSU and CEHMM seeks to continue its relationship with the NMSU Agricultural Science Center (ASC) as the model farm for growing algae for the production of biodiesel; and

WHEREAS, CEHMM seeks to secure surface occupancy to twenty (20) acres of land at the NMSU Agricultural Science Center at Artesia, New Mexico, for the purposes of evaluating potential new releases of algae and the exploration of vertically integrating algae growth, harvesting, oil extraction and conversion to biodiesel, and

WHEREAS, the ASC has land that is not in production that can be used for perfecting and demonstrating the processes needed for farmers in Southeastern New Mexico, and

WHEREAS, a limited amount of water can be used to help support the project, and

WHEREAS, faculty and staff at the ASC have experience with agronomic practices, alternative cropping systems, beneficial reuse of potential waste streams, educating students, and working relationships with area farmers that will prove invaluable to the long-term success of this project, and

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WHEREAS, The Southeastern New Mexico Agricultural Research Association (SENMARA) Board of Directors is also in favor of this relationship and supports CEHMM's endeavors, and

WHEREAS, NMSU desires to continue its relationship with CEHMM in promoting CEHMM's endeavors;

IT IS THEREFORE MUTUALLY AGREED:

1. Land and Water Provision

1.1 NMSU shall provide the twenty (20) acres of land described as SE/4, SE/4, N/2, Section 16, Township 18 South, Range 26 East to CEHMM for a term beginning December 1, 2010 and terminating at 11:59 p.m. on November 30, 2020.

1.2 CEHMM agrees to pay $1500 per month, each payment is due on the fifteenth (15th) day of each month and is to be made to New Mexico State University at the following address:

New Mexico State University
Sponsored Projects Accounting
MSCSPA
PO Box 30002
Las Cruces, NM 88003-8002

1.3 CEHMM agrees to pay for all utilities and support services required to operate the subject project facility (e.g, electricity, gas)

1.4 CEHMM agrees that upon the termination of this agreement, it will surrender, yield up and deliver the subject premises in good and clean condition, except the effects of ordinary wear and tear arising from lapse of time, or damage without fault or liability to CEHMM.

1.5 During the term of this Agreement, at CEHMM's expense, CEHMM shall procure and maintain a public liability and business automobile insurance policy, covering all claims for bodily injury and property damage, including loss of use thereof, in an amount not less than the coverages stated below:

General Liability - Bodily Injury and Property Damage	$2,000,000
Automobile Liability - Bodily Injury and Property Damage	$1,000,000

1.6 CEHMM assumes responsibility and agrees to pay for any and all property losses or personal injuries arising out of the use and occupancy of the subject premises, which are incurred by reason of the negligence by the CEHMM or its employees or agents to the full extent permitted by the Laws of the State of New Mexico.

1.7 CEHMM retains exclusive authority to control access to the subject property and infrastructure therein commensurate with reasonable actions necessary to provide protection of personnel, capital assets, and intellectual property.

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1.8 NMSU and CEHMM shall work cooperatively to provide water and requisite appurtenant water rights necessary for the scope of work and project in which CEHMM engages. CEHMM will negotiate the transfer of rights to the farm in accordance with project requirements versus water availability, appurtenant rights, and appropriations within the limitations of the Artesia Basin. Based on appropriations on projected five year allocations, NMSU agrees to allow CEHMM access to the volume of water that is underutilized on their permit.

1.9 In the event of a significant change in leadership of CEHMM, this agreement will become void and must be re-negotiated among the new leadership members.

2. Intellectual Property.

2.1 "Intellectual Property" is, without limitation, unpublished patent applications, any inventions, improvements, processes, methodologies and/or discoveries, published or unpublished, that may or may not be legally protectable, including all know-how, copyrights, trade secrets, research plans and priorities, research results and related reports, statistical models and computer programs and related reports, and market interests and product ideas which are confidential and not public information.

2.2 NMSU agrees that all ideas, improvements, and inventions conceived of, developed, or first reduced to practice in the performance of, relating to or arising from the services provided hereunder for CEHMM and that any reports, studies, and other tangible and/or intangible material of any nature shall become the sole and exclusive property of CEHMM and shall be deemed "works made for hire" of which CEHMM shall be deemed the author. To the extent that the materials are not deemed "works made for hire," NMSU shall make an exclusive perpetual, royalty-free assignment of all copyrights in such materials to CEHMM. NMSU shall not be entitled to make any use of the materials except as may be expressly permitted in this Agreement. Upon CEHMM's request, any and all such property shall be promptly delivered to CEHMM, including any and all copyright interests, and that any ideas, information, and data received by CEHMM, and ideas and developments accruing therefrom, shall all be fully disclosed to CEHMM, shall all be CEHMM's exclusive property, and may be dealt with by CEHMM as such, all without payment of further consideration.

2.3 If requested, NMSU shall promptly disclose to CEHMM, in writing, any and all inventions, discoveries and improvements conceived or made by NMSU during the period of NMSU's services under this Agreement and related to CEHMM's business or activities. NMSU shall assign, and agrees to assign, all of the NMSU's interests therein to CEHMM or its nominee. NMSU further agrees to preserve such as confidential during the term of this Agreement and thereafter. NMSU shall execute all papers and documents necessary to vest title to such ideas, developments, information, data, improvements, and inventions in CEHMM so as to enable CEHMM to apply for and obtain patents and/or copyright registration on such ideas, developments, works of authorship, information, data, improvements, and inventions in any and all countries, and to assign to CEHMM the entire right, title, and interest thereto, all at CEHMM's expense.

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2.4 Whenever CEHMM requests NMSU to do so, NMSU shall execute any and all applications, assignments or other instruments which CEHMM shall deem necessary to apply for and attain Patents of the United States or any foreign country or to otherwise protect CEHMM's interests therein. These obligations shall continue beyond the termination of this Agreement with respect to inventions, discoveries and improvements conceived or made by NMSU during the performance of the services, and shall be binding upon the parties' successors, successors-in-interest, purchasers, assigns, executors, administrators and other legal representatives.

2.5 NMSU understands that subsequent to its performance hereunder, NMSU's assistance may be needed in regards to securing, defending or enforcing any patent that NMSU is an inventor or co-inventor. In that event, NMSU shall provide all such assistance and CEHMM agrees that CEHMM shall pay reasonable compensation for NMSU's time at a rate to be agreed but not higher than the last salary rate paid to NMSU by CEHMM during NMSU's performance this Agreement.

2.6 NMSU warrants that, in the performance of this Agreement, NMSU's work product and the information, data, designs, processes, inventions, techniques, devices, and other such intellectual property furnished, used, or relied upon by NMSU will not knowingly infringe any copyright, patent, trademark, trade dress, or other intellectual property right of NMSU or others. NMSU shall inform CEHMM in writing, in advance, if NMSU's performance, furnishing, use, or reliance could reasonably be deemed to infringe any patent, copyright, trademark, trade dress, or other such intellectual property right of NMSU or of others.

3. Confidentiality of Material

3.1 During the course of providing NMSU providing services under this Agreement, NMSU may have access to, and acquire knowledge from, materials, data other information with respect to CEHMM that may not be accessible or known to the general public, including all information in tangible or intangible form that is proprietary to the CEHMM and has, or could have, commercial value in the business in which CEHMM is engaged and third party proprietary or confidential information that CEHMM treats as confidential (*hereinafter referred to as "Confidential Information"*).

When confidential or proprietary information is disclosed, it will be marked as such with a legend so the other party is aware of its confidentiality and proprietary nature. If discussions take place that involve confidential or proprietary information, documentation of such disclosure shall take place within three (3) to five (5) business days and a written copy provided to the other party.

3.1.1 Confidential Information shall not include any information that: (a) has entered, or subsequently enters, the public domain without NMSU's breach of any obligation under this Agreement; (b) was known to NMSU prior to CEHMM's disclosure of such information to NMSU; (c) is obtained from a third party without violation of an obligation of nondisclosure and without restrictions on its disclosure; or (d) is independently developed by NMSU without reference to the Confidential Information.

AE 10/20/10

10-20-2010

3.2 Any knowledge acquired by NMSU from such Confidential Information or otherwise through its engagement under this Agreement shall not be used by NMSU other than for the limited purpose of performing services for CEHMM under this Agreement. NMSU shall not use, publish or divulge such Confidential Information in connection with any products sold or services rendered by NMSU to any other person, firm or corporation, in any advertising or promotion regarding NMSU or its products or services, or in any other manner or connection whatsoever without first having obtained CEHMM's written permission. CEHMM has the sole discretion to withhold permission.

3.3 Nothing in this Agreement shall be deemed or construed to grant NMSU a license to use, sell, develop, exploit, copy, or further develop any Confidential Information acquired by NMSU through its engagement hereunder.

3.4 NMSU shall not disclose to CEHMM nor induce CEHMM to use any secret process, trade secret, or other confidential knowledge or information belonging to others, unless required to disclose by a court of competent jurisdiction.

4. Notices.

4.1 Any notice or other communication required or permitted to be given under this Agreement shall be given in writing and delivered in person, mailed or delivered by recognized courier service, properly addressed and stamped with the required postage, to the intended recipient at its address specified below and shall be deemed effective upon receipt. Either party may from time to time change its address by giving the other party notice of the change in accordance with this section.

If to NMSU:

Technical Contact:

Dr. Robert P. Flynn
67 East Four Dinkus Road
Artesia, NM 88210
T: 575-748-1228
Fax: 575-748-1229
Email: rflynn@nmsu.edu

Administrative Contact:

Mr. Ancelmo Encinias
Office of Grants & Contracts
Box 30002, MSC OGC
Las Cruces, NM 88003-8002
T: 575-646-2063
Fax: 575-646-2020

If to CEHMM:

Mr. Douglas C. Lynn
Executive Director
505 N. Main Street
Carlsbad, NM 88220
T: 575-885-3700
Fax: 575-885-6422
Email: dclynn@cehmm.org

10/20/10

10-20-2010

5. Disposition of Funds

5.1 Fixed Price payments from this agreement shall be disbursed in accordance with Article 1.2 herein to perform the approved scope of work and will include an applicable F&A rate of 26% throughout the term of the agreement. The budget must not exceed a total of $18,000 per year and major changes to the scope of work must be approved by both parties herein.

6. Duration & Termination.

6.1 This Agreement shall begin December 1, 2010 and terminate at 11:59 p.m. on November 30, 2020. During the of this Agreement, CEHMM and/or NMSU, at its option, may terminate this Agreement for any reason upon submitting to NMSU written notice thirty (30) days prior to the effective date of termination.

7. Miscellaneous.

7.1 NMSU represents and warrants to CEHMM that it has the experience and skill to perform the requirements under this Agreement. NMSU and CEHMM shall comply with all applicable federal, state and local laws in effect during the period of performance.

7.2 NMSU warrants that no person or selling agency has been or will be employed or retained to solicit or secure any contract, including, but not limited to, a U.S. government contract, upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by NMSU for the purpose of receiving business. For breach or violation of this warranty, CEHMM shall have the right to annul this Agreement without liability or, in its discretion to deduct from the fee or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

7.3 NMSU hereby represents and warrants that no part of the fee paid by CEHMM will be used directly or indirectly to make payments, gratuities, emoluments, or to confer any other benefit to an official of the U.S. government or any political party.

7.4 NMSU further covenants that there is no agreement between it and any other person, firm, or corporation that would cause this Agreement not to have full force and effect.

7.5 NMSU agrees to not directly recruit current employees of CEHMM for the purposes of employment with NMSU, or any other firm that NMSU may be affiliated with. Further, NMSU agrees to refrain from such recruitment of CEHMM employees for a period of two (2) years following the expiration date of this Agreement.

7.6 NMSU shall not hold itself out as CEHMM's agent or representative. NMSU shall render its services as an independent contractor and it shall have no authority to bind or obligate CEHMM in any manner.

7.7 This Agreement shall be construed and interpreted in accordance with the laws of the State of New Mexico.

10-20-2010 10/20/10

8. Entire Agreement.

8.1 This Agreement may not be assigned, modified or amended in any respect, except by a writing signed by the authorized representatives of the parties. The parties to this Agreement mutually agree that this Agreement constitutes the entire understanding and agreement of the parties with respect to the subject matter hereof, and neither they nor their agents shall be bound by any terms, conditions, statements, warranties, or representations, oral or written, not herein contained and any representation, premise or condition not specifically incorporated herein shall not be binding upon either party.

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed by their duly authorized representatives as of the date first written above.

THE REGENTS OF NEW MEXICO STATE UNIVERSITY		**CENTER OF EXCELLENCE FOR HAZARDOUS MATERIALS MANAGEMENT**	
Signed:		Signed:	
Name:	Neta Fernandez	Name:	Douglas C. Lynn
Title:	Director Office of Grants & Contracts	Title:	Executive Director
Date:	10/20/2010	Date:	10-20-2010

NM STATE UNIVERSITY

Office of Real Estate
MSC 3ORE
New Mexico State University
P.O. Box 30001
Las Cruces, NM 88003-8001
Phone: (575) 646-2807 Fax: (575) 646-3800

May 27, 2011

Center of Excellence for Hazardous Materials Management
505 N. Main
Carlsbad, NM 88220

RE: Third Amendment to Lease Agreement

Dear Mr. Lynn,

Enclosed is one fully executed agreement to the third amendment to the lease agreement for the location of 67 E. Four Dinkus Road in Artesia, NM, for your records.

Thank you,

Tish Limpin

Tish Limpin
Senior Administrative Assistant
Administration and Finance

THIRD AMENDMENT TO LEASE AGREEMENT
BETWEEN
CENTER OF EXCELLENCE FOR HAZARDOUS MATERIALS MANAGEMENT, INC.
AND
THE REGENTS OF NEW MEXICO STATE UNIVERSITY

This THIRD amendment to that certain Lease Agreement dated June 12, 2009, as amended, is entered into this 3rd day of August, 2011 by and between the Center of Excellence for Hazardous Materials Management, Inc. (CEHMM) and the Regents of New Mexico State University (NMSU) to further amend the original Lease Agreement.

It is hereby agreed that amended Section 2. Term is deleted in its entirety and replaced with:

2. **Term**

The term of this lease is twelve months, beginning on September 16, 2011 and ending on September 15, 2012.

All other terms and conditions of the original Lease Agreement shall remain in full force and effect.

CENTER OF EXCELLENCE FOR HAZARDOUS MATERIALS MANAGEMENT, INC.

By: _____
Douglas C. Lynn, Executive Director

Date: 07-07-11

REGENTS OF NEW MEXICO STATE UNIVERSITY

By: _____
Barbara Couture
President

Date: 7/26/11

LEASE AGREEMENT

This lease agreement is made and entered into between the COLLEGE OF AGRICULTURAL CONSUMER AND ENVIRONMENTAL SCIENCES/ Ag. Science Center – ARTESIA and the Center of Excellence for Hazardous Materials Management, Inc., a 501(c)(3) not for profit corporation ("CEHMM").

1. Property

Ag. Science Center – Artesia hereby leases to CEHMM for the term of this lease the property located at 67 E. Four Dinkus Rd. Artesia, NM 88210. The aforementioned property is a Pecos Hilton A346K trailer.

2. Term

The term of this lease is on a month to month basis as of September 15, 2011.

3. Rent

CEHMM agrees to pay rent in the amount of $500 per month, each payment due is on the (15th) day of each month and is to be made to (New Mexico State University) at the following address:

NMSU-ASC Artesia
67 E. Four Dinkus Rd.
Artesia, NM 88210

4. Utilities/Services

NMSU agrees to provide the utilities and services indicated:

__X__ Electricity __X__ Gas __X__ Water

5. Termination

It is understood and agreed that this lease may be terminated by either party upon thirty (30) days written notice.

6. Surrender of Leased Premises

CEHMM agrees that upon the termination of this lease, it will surrender, yield up and deliver the Leased Premises in good and clean condition, except the effects of ordinary wear and tear arising from lapse of time, or damage without fault or liability to CEHMM.

7. NMSU's Right of Access

NMSU may not enter the Leased Premises without having given CEHMM at least 24 hours notice, except in case of an emergency. NMSU may enter to inspect and or repair property if notice is given.

8. Insurance

Each Party hereby releases the other from claims for recovery for any loss or damage to any property owned by either party which is insured under valid and collective insurance policies. Landlord is not responsible for any loss or damage of property that belongs to the Tenant.

9. Liability

CEHMM assumes responsibility and agrees to pay for any and all property losses or personal injuries arising out of the use and occupancy of the Leased Premises, which are incurred by reason of the negligence by the CEHMM or its employees or agents to the full extent permitted by the Laws of the State of New Mexico.

10. Agreement

This lease contains the complete understanding of the parties hereto and is not assignable.

Any agreement to change the terms of this lease in any way shall be valid only if the change is made in writing and approved by mutual agreement of authorized representatives of the parties hereto.

11. Governing Law

This lease will be governed by the laws of the State of New Mexico.

If one or more of the provisions of this lease shall be held to be invalid, illegal or unenforceable in any respect, the validity, legality and enforceability of the remaining provisions shall in no way be affected or impaired thereby.

12. Notices

All notices required to be given or provided for pursuant to this lease shall be in writing and shall be delivered personally, by overnight courier service or sent by certified or registered mail, postage prepaid and return receipt requested. Notices to NMSU and CEHMM shall be addressed as follows:

NMSU- ASC Artesia
67 E. Four Dinkus Rd.
Aretsia, NM 88210

CEHMM
505 N. Main St.
Carlsbad, NM 88220

IN WITNESS THEREOF, the parties have executed this lease, on the dates indicated below.

CENTER OF EXCELLENCE FOR HAZARDOUS MATERIALS MANAGEMENT

By:_____ Date: 10-03-11

Douglas C. Lynn, Executive Director

COLLEGE OF AGRICULTURAL CONSUMER AND ENVIRONMENTAL SCIENCES/ Ag. Science Center – ARTESIA

By:_____ Date: 9/19/2011

Robert Flynn, Superintendent

EXHIBIT "3"

R&D	Biweekly Salary	Biweekly MCR/SS	Biweekly 401K	Biweekly SUTA	Monthly Accrued PTO Earned	Monthy Health	Monthly Dental	Monthly Life	Monthly AD&D	Monthly STD	Monthly LTD	Monthly WC
Workers Comp												498.50
Job 1	4,534.54	346.89	226.73	106.94	872.00	602.03	29.21	48.00	2.00	30.00	42.25	
Job 2	1,910.40	146.15	95.52	39.97	367.38	1,852.94	106.03	24.00	1.00	17.22	17.80	
Job 3	1,520.00	116.28	30.40	36.39	292.31	-	29.21	19.20	0.80	13.68	14.16	
Job 4	5,378.59	411.46	268.93	123.21	1,034.31	926.47	53.02	24.00	1.00	15.00	21.50	
Job 5	2,830.77	216.55	141.54	67.62	544.31	-	106.03	36.00	1.00	25.50	26.37	
Job 6	2,585.86	197.82	129.29	58.13	497.23	1,244.98	63.59	32.64	1.36	23.28	24.09	
TOTAL	18,760.16	1,435.15	892.41	432.26	3,607.54	4,626.42	387.08	183.84	7.16	124.68	146.17	498.50
ANNUAL	**487,764.16**	**37,313.96**	**23,202.61**	**11,238.76**	**43,290.48**	**55,517.04**	**4,645.02**	**2,206.08**	**85.92**	**1,496.16**	**1,754.04**	**5,982.00**

TOTAL
674,496.23

Exhibit 4

CEHMM (BIODIESEL PROJECT)

Item Description	Inventory #	Useful Life	Serial # / Model #	Date	Purchase Amount	Accumulated Depreciation 6/30/2011	Depreciation 6/30/2012	Net Value
Ditch Witch Trencher	11907	72	CAV-04361	11/6/2009	$ 16,250.00	$ 4,288.11	$ 2,708.28	$ 9,253.61
Extraction Module: 2 Reactors	12064	120		11/6/2009	$ 162,208.36	$ 25,682.87	$ 16,220.76	$ 120,304.73
Seperation Module: 1 Seperator	12065	120		11/6/2009	$ 116,208.33	$ 18,399.60	$ 11,620.80	$ 86,187.93
Solvent Recovery Module	12066	120		11/6/2009	$ 248,208.33	$ 39,299.60	$ 24,820.80	$ 184,087.93
Makedown Module: 2 Tanks	12067	120		11/6/2009	$ 29,208.33	$ 4,624.60	$ 2,920.80	$ 21,662.93
Spent Biomass Quality Control Module	12068	120		11/6/2009	$ 29,208.33	$ 4,624.60	$ 2,920.80	$ 21,662.93
Utility Skid	12069	120		11/6/2009	$ 71,208.32	$ 11,274.60	$ 7,120.80	$ 52,812.92
20'x20'x10' Metal Building	12073	240		12/22/2009	$ 5,778.75	$ 433.26	$ 288.84	$ 5,056.65
Protector Solvent Storage Cabinets	12010	N/D	46610-458	1/22/2010	$ 1,452.08	$ -	$ -	$ 1,452.08
Solvent Cabinet Vent Kit	12011	N/D	89033-090	1/22/2010	$ 292.33	$ -	$ -	$ 292.33
Acid Cabinet Vent Kit	12012	N/D	15202-504	1/22/2010	$ 179.89	$ -	$ -	$ 179.89
Protector Acid Storage Cabinet	12013	N/D	46610-456	1/22/2010	$ 951.96	$ -	$ -	$ 951.96
Protector Premier Laboratory Hood	12014	120	74920-034	1/22/2010	$ 8,937.63	$ 1,266.16	$ 893.76	$ 6,777.71
Work Surface Spills Topper	12015	N/D	74920-076	1/22/2010	$ 937.50	$ -		$ 937.50
44' x 10' Portable Office Trailer	12044	72		2/26/2010	$ 14,642.00	$ 3,253.76	$ 2,440.32	$ 8,947.92
Trilogy Fluorometer	12197	144	7200	4/23/2010	$ 15,682.82	$ 1,524.60	$ 1,306.80	$ 12,851.42
Portable Octane Analyzer	12198	144	K88600	4/23/2010	$ 10,950.00	$ 1,064.56	$ 912.48	$ 8,972.96
Mass Spectrometer	12276	120	7890AMSD	4/30/2010	$ 142,617.54	$ 16,638.58	$ 14,261.64	$ 111,717.32
Pond Monitoring System	12199	N/D		4/30/2010	$ 3,511.61	$ -		$ 3,511.61
Closed Cup Flash Point Tester	12239	144		6/18/2010	$ 15,100.00	$ 1,363.18	$ 1,258.32	$ 12,478.50
Weather Station	12240	120	DYNAMET	6/18/2010	$ 12,575.00	$ 1,362.27	$ 1,257.50	$ 9,955.23
Pond Vacuum	12265	60		6/29/2010	$ 11,771.00	$ 2,550.34	$ 2,354.16	$ 6,866.50
500 Gallon Barrel Single Tank	12282	120	SAGSC4519AS649901	8/6/2010	$ 32,750.00	$ 2,729.10	$ 3,275.00	$ 26,745.90
14'x83" Dump Trailer	12283	60	5R8D81422AM015758	8/6/2010	$ 6,670.00	$ 1,111.60	$ 1,334.00	$ 4,224.40
Aspirating Aerators	12776	N/D	AIRE02	9/29/2011	$ 1,313.19	$ -	$ -	$ 1,313.19
Aspirating Aerators	12777	N/D	AIRE02	9/29/2011	$ 1,313.20	$ -	$ -	$ 1,313.20
Aspirating Aerators	12778	N/D	AIRE02	9/29/2011	$ 1,313.19	$ -	$ -	$ 1,313.19
Multi Parameter Meter with Cable	12775	N/D	Y556	10/6/2011	$ 3,104.70	$ -	$ -	$ 3,104.70
3" Trash Pump with Gasoline Motor	12720	N/D	GCAHT-1418028	10/6/2011	$ 1,000.71	$ -	$ -	$ 1,000.71
3" Trash Pump with Gasoline Motor	12721	N/D	GCAHT-1418012	10/6/2011	$ 1,000.71	$ -	$ -	$ 1,000.71
3" Trash Pump with Gasoline Motor	12722	N/D	GCAHT-1418009	10/6/2011	$ 1,000.71	$ -	$ -	$ 1,000.71
18'x83" Utility Trailer	12858	N/D	5VYBL1826BH003661	10/27/2011	$ 3,829.00	$ -	$ -	$ 3,829.00
PH Controller with Valve Solenoid	12822	N/D	757457	11/4/2011	$ 1,226.76	$ -	$ -	$ 1,226.76
PH Controller with Valve Solenoid	12823	N/D	757456	11/4/2011	$ 1,226.76	$ -	$ -	$ 1,226.76
PH Controller with Valve Solenoid	12824	N/D	708557	11/4/2011	$ 1,226.76	$ -	$ -	$ 1,226.76
PH Controller with Valve Solenoid	12825	N/D	708558	11/4/2011	$ 1,226.75	$ -	$ -	$ 1,226.75
TOC Analyzer	12827	120	1109-0330	11/7/2011	$ 36,683.49	$ -	$ 2,139.90	$ 34,543.59
Aerator 3HP 3 Phase	12881	N/D	7444	11/9/2011	$ 1,291.51	$ -	$ -	$ 1,291.51
Aerator 2HP 2 Phase	12882	N/D	7415	11/9/2011	$ 1,327.22	$ -	$ -	$ 1,327.22
Aerator 2HP 2 Phase	12883	N/D	7446	11/9/2011	$ 1,327.22	$ -	$ -	$ 1,327.22
				Total	**$ 1,016,711.99**	**$ 141,491.39**	**$ 100,055.76**	**$ 775,164.84**

FINAL TECHNICAL REPORT

DOE AWARD NUMBER – DE-FG29-04SR20282

AWARDEE – CENTER OF EXCELLENCE FOR HAZARDOUS MATERIALS MANAGEMENT

PROJECT TITLE – Establish and operate the Center of Excellence in Hazardous Materials at the WIPP Site in Carlsbad, NM which will focus its activities on reducing waste streams that threaten public health along the U.S.-Mexico border

PROJECT DIRECTOR – DOUGLAS C. LYNN

CONSORTIUM/TEAMING MEMBERS – N/A

DISTRIBUTION LIMITATIONS – NONE

EXECUTIVE SUMMARY

The Center of Excellence for Hazardous Materials Management (CEHMM) was awarded $1,987,000.00 on September 3, 2004, award number DE-FG29-04SR20282. This award was used to establish the organization and initiate investigations of hazardous waste issues along the U.S.-Mexico border.

Through cooperation with Federal agencies, Texas state agencies and New Mexico state agencies data derived from the main project proved to be of significant benefit to the public. Benefits derived included research and communication (e.g, education and outreach) that were initiated by CEHMM. CEHMM maintained open communication and cooperation with state and federal regulatory agencies including national labs and universities. CEHMM has exhibited a willingness to share any information resulting from the research conducted along the U.S.-Mexico border.

Scientific investigations conducted during the execution of this grant contributed significant data and established new sampling protocols to the dimension, frequency and severity of hazardous materials (e.g., heavy metals) along the U.S.-Mexico border. Additionally, new protocols and assessments with distinct Homeland Security implications were embedded thus establishing a baseline that will be significant for related investigations in the future.

PROJECT SUMMARY

The Center of Excellence for Hazardous Materials Management (CEHMM) was awarded $1,987,000.00 on September 3, 2004, award number DE-FG29-04SR20282. This award was used to establish the organization and initiate investigations of hazardous waste issues along the U.S.-Mexico border. The project concluded September 30, 2009.

The first action under the grant was to establish CEHMM. CEHMM was formed as a 501(c)(3) not-for-profit organization. CEHMM was granted not-for-profit classification on April 22, 2005. In parallel with forming the organization a web site was developed (www.cehmm.org) to disseminate information on the progress of CEHMM and any information that pertained to the research being conducted and information on the issues that were of interest to the award. The web site continues to be maintained and updated. The information from this award will continue to be accessible at the web site.

Project dimensions included the following:

- Education
- Monitoring
- Research and Development
- Information/Technical support
- Risk Management and Policy

Information/technical support was accomplished quickly with the design and formulation of the CEHMM web site. The web site continues to be a useful tool for the organization.

Initially, education and training were examined to see if there were interests and a market to hold OSHA approved environmental, safety and health short courses in the Carlsbad, NM and El Paso TX areas. Meetings were held with the University of Texas-El Paso, New Mexico Junior College, Carlsbad Environmental Monitoring and Research Center, New Mexico State University and Texas Engineering Extension Service to pursue the educational aspect of the award. After the meetings and one OSHA class (with the help of Texas Engineering Extension Service) in Carlsbad, NM, the decision was made with the support of the DOE contracting officer to halt the education efforts due to lack of interest and need.

In response to public concerns and in alignment with the subject grant's terms and conditions, monitoring, research and development were consolidated into one project (see attached report). This project lasted 2.5 years and provided valuable information for the border region and the scientific community at large.

Risk management and policy was not pursued due to funding constraints and the success of the biomonitoring project.

The attached report, Biomonitoring of Chihuahuan Ravens: Prevalence of Environmental Contaminants, Avian Influenza Virus, and West Nile Virus, by Dr. Marco Restani, and the CEHMM web site (www.cehmm.org) were the two items produced under this award. No license agreements, patents or patent applications were produced under the auspices of this grant.

BIOMONITORING OF CHIHUAHUAN RAVENS: PREVALENCE OF ENVIRONMENTAL CONTAMINANTS, AVIAN INFLUENZA VIRUS, AND WEST NILE VIRUS

--- Final Report ---

Submitted by

Marco Restani, Ph.D.
Department of Biological Sciences
St. Cloud State University
St. Cloud, MN 56301

29 September 2009

Submitted to

Center of Excellence for Hazardous Materials Management
505 North Main Street
Carlsbad, NM 88220

TABLE of CONTENTS

Cover photograph: Chihuahuan ravens and American crows arriving at a large, seasonal nocturnal roost in El Paso, Texas, 2009.

ABSTRACT--The goal of this study, based on CEHMM Request For Proposals (RFP) # 002-2007 (as amended), was to collect baseline data on prevalence of environmental contaminants, West Nile Virus, and Avian Influenza in Chihuahuan ravens (*Corvus cryptoleucus)*. The study area extended from Hobbs, NM to El Paso, TX. We banded 202 ravens (101 nestlings, 101 adults) from 2007-2009. All ravens sampled for heavy metals had detectable levels of selenium in blood. Nestling ravens ($n = 14$) had mean ± SE ppm levels representative of background exposure (0.33 ± 03 ppm). Adult ravens ($n = 36$) had significantly higher mean levels ($t = 7.21$, $df = 48$, $p < 0.001$; test conducted on log transformed data), but which were nonetheless relatively low (0.85 ± 0.08 ppm). Only 15 of 61 (25%) ravens sampled had detectable levels of lead in blood (0.11 ± 0.01 ppm, range 0.06 – 0.23 ppm). Mercury was detected in 21 of 61 (34%) ravens sampled, and all levels in blood were very low (0.034 ± 0.003 ppm, range 0.020-0.056 ppm). PCBs within Arcolor mixtures were not detected in either nestling or adult ravens during 2007. Forty-four raven samples were analyzed for organochlorine pesticides. Twelve of 44 (27%) ravens – all adults - had detectable levels of pp-DDE in blood (range 16-270 ppb, mean 77 ± 20 ppb). Neither virus was detected in ravens ($n = 170$ for Avian Influenza, $n = 180$ for West Nile Virus). None of the contaminant levels reported were of environmental concern despite the extensive sampling conducted both across the study area and within specific regions considered at risk to pollution (e.g., El Paso).

BACKGROUND

The Center of Excellence for Hazardous Materials Management (CEHMM) in Carlsbad, New Mexico established a Biomonitoring Project in the border region of New Mexico, Texas, and Mexico in 2007. Environmental health along the U.S. – Mexico border has been a concern to residents of both countries because of the increased level of industrialization in the region following enactment of the North American Free Trade Agreement. Mexico has exercised less stringent environmental controls and enforcement than the U.S. (Carter et al. 1996). For example, the use of DDT has been banned in the U.S. for nearly 40 years, whereas Mexico produced and used more DDT in antimalaria campaigns than other Latin American country during the 1970s and 1980s, which created a significant local public health problem (Lopez-Carrillo 1996). Public health experts have urged increased monitoring of hazardous wastes and of chemical exposure in air, water, floral, and faunal resources within the border region to address these environmental concerns (Carter et al. 1996). Recent studies conducted along the border have reported contaminant levels in fish (Wainwright et al. 2001), snakes (Clark et al. 2000), raptors (Mora et al. 2002), and doves (Fredricks et al. 2009). In some individuals, levels were high and of concern.

Birds are particularly valuable indicators of environmental contamination (Beyer et al. 1996). Upper trophic level species, such as raptors and colonial waterbirds, bioaccumulate contaminants contained within terrestrial and aquatic prey and thus provide early warning of harmful environmental levels of heavy metals, organochlorines (OCs), polychlorinated biphenyls (PCBs), and organophosphates. These contaminants exhibit both sublethal and lethal effects, ranging from behavioral aberrations to widespread wildlife population declines. These compounds also continue to pose a threat to human health.

CEHMM proposed the Chihuahuan raven (*Corvus cryptoleucus*), a predatory/scavenger species that bioaccumulates toxins and pathogens, as the model organism to monitor environmental contaminants within the border region. In addition to environmental contaminants, CEHMM proposed ravens to assess prevalence of West Nile Virus and Avian Influenza. Ravens were an appropriate choice as the model organism because they 1) are a top-of-the-food-chain omnivore, thus their foraging samples a large ecological range of environmentally sensitive prey, from insects to small mammals to birds; 2) are abundant throughout different habitat types within the region; and 3) are largely non-migratory, which reduces the confounding effects of point exposure outside the U.S. and subsequent data interpretation (Bednarz and Raitt 2002).

The CEHMM Biomonitoring Project was intended to collect baseline information for a period of three years, beginning in 2007. Extending the study over multiple years was necessary to establish mean levels, and associated variation, of environmental contaminants and pathogens, and to obtain the statistical power to detect trends and distributions over the large study area. The project included several important collaborators and cooperators: the Los Alamos National Laboratory, the New Mexico Department of Agriculture's Veterinary Diagnostic Services, and the California Animal Health and Food Safety Laboratory (University of California-Davis). The New Mexico Game and Fish Department, Texas Parks and Wildlife, and the U.S.G.S. Bird Banding Laboratory (Patuxent Wildlife Research Center) permitted field activities and sample collections. The project was conducted through the Department of Biological Sciences, St. Cloud State University (SCSU), Minnesota.

The goal of this study, based on CEHMM Request For Proposals (RFP) # 002-2007 (as amended), was to collect baseline data on prevalence of environmental contaminants, West Nile Virus, and Avian Influenza. Non-destructive sampling of ravens was advocated for the following contaminants: heavy metals (lead, mercury, and selenium), organophosphates (indicated by cholinesterase activity), organochlorine pesticides (OCs), and polychlorinated biphenyl compounds (PCBs). Specific RFP requirements/objectives included:

- locate and sample raven nestlings from not less than 15 nests
- sample ravens for contaminants and viruses
- band ravens and submit banding reports
- prepare scientific publications.

This report summarizes field data collected during the 2007-2009 calendar years. See Restani (2008, 2009) for earlier results and interpretations from the 2007 and 2008 field seasons, respectively.

STUDY AREA and METHODS

The study area extended along a corridor from near Hobbs, New Mexico through the greater Carlsbad area (Los Medanos), south to Dell City, Texas, and west to El Paso, Texas (Fig. 1). All field efforts were confined to the U.S. During 2007-2009, field work extended throughout the calendar year and was focused near Carlsbad, Eunice, Sierra Blanca, Dell City, and El Paso. My assistants and I searched suitable raven habitat for stick nests beginning in April (Fuller and Mosher 1987). Nests were located from a distance with a spotting scope or with the use of a mirror pole (Fig. 2), and locations were plotted with a handheld Global Positioning System (UTM, NAD 27). We did not search for nests at midday, when temperatures commonly exceeded 35°C, or during inclement weather, so as to reduce egg and nestling exposure (Grier and Fyfe 1987). Nest activity and chronology were established by use of a mirror pole. We returned to nests once after eggs hatched when young were 3-5 weeks old to collect samples (blood, oral-pharyngeal and cloacal swabs – see below) for analyses and to band young. Young ravens were returned to nests following sampling, which averaged 30 minutes and sampling nestlings typically took place from late June to early July.

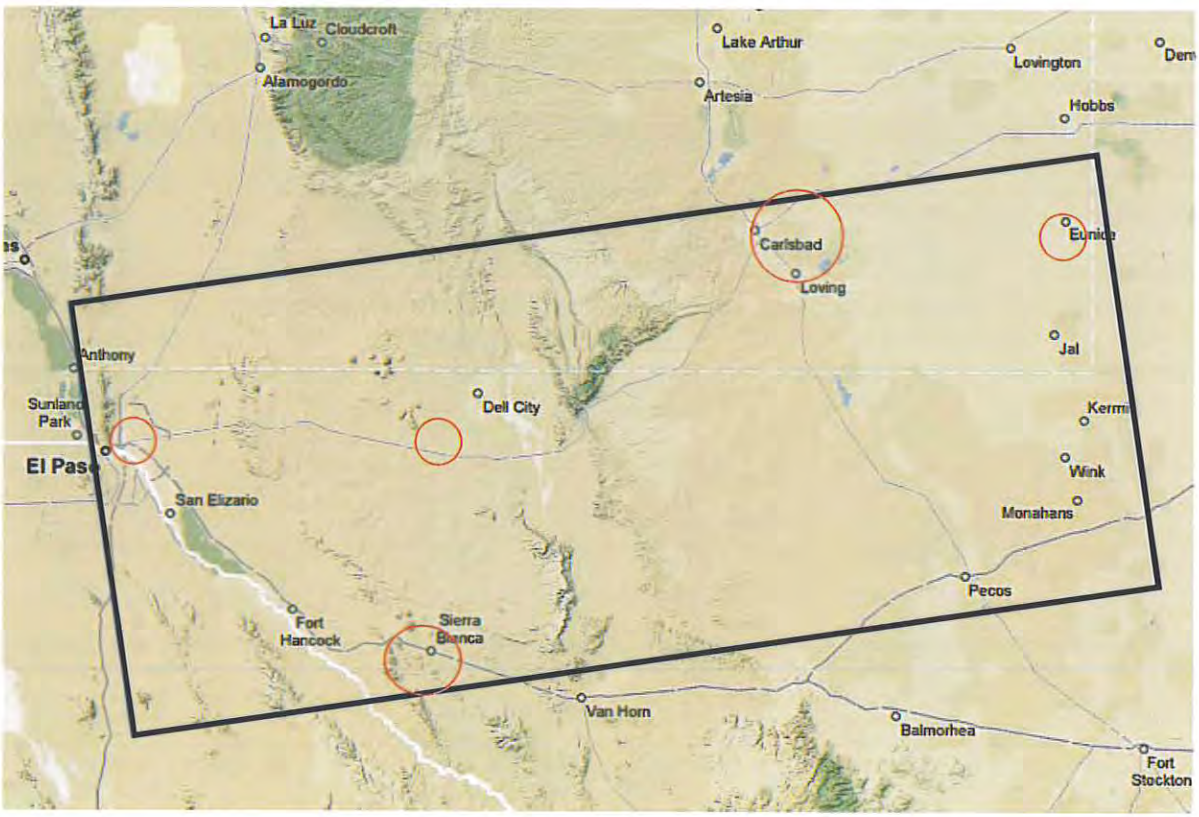


Figure 1. Approximate location of the study area corridor along the border region of the U.S. and Mexico, 2007-2009. Red circles identify areas where most raven sampling occurred (circle size represents relative sampling effort).

A)

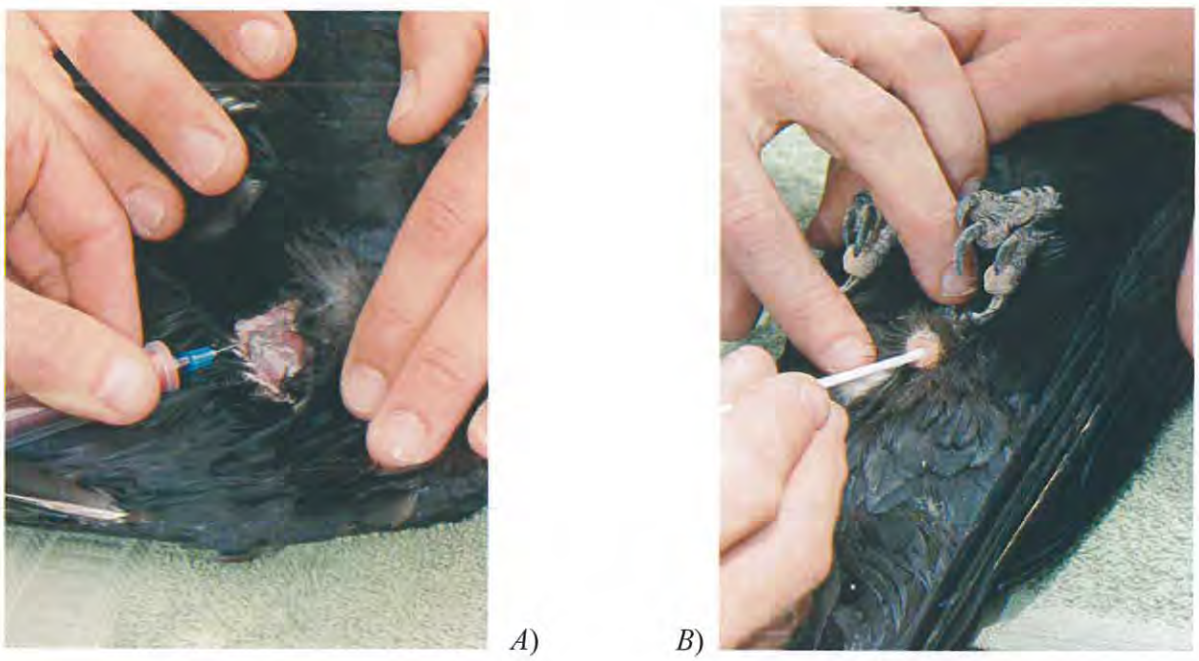
B)

Figure 2. A) Locating raven nests with the aid of a mirror pole. B) A brood of raven nestlings nearing fledging age.

We used a remotely-triggered net launcher (Coda Enterprises, Inc.) to capture free-flying ravens attracted to garbage bait at municipal landfills (Fig. 3) and nocturnal roosts (Caffrey 2001). We collected samples (blood, oral-pharyngeal and cloacal swabs) and banded captured ravens, which were released at the site of capture within one hour. Trapping for ravens occurred in January, February, April, June, July, November, and December.

Figure 3. The capture of 15 Chihuahuan ravens a the Eunice, New Mexico, landfill. Arrow indicates the location of the net launcher.

We used a heparinized 25-gauge needle and 6 cc syringe to collect approximately 3 cc of blood from the brachial vein of nestling and free-flying ravens following standard sterile field procedures (see Harmata and Restani 1996, Miller et al. 1998) (Fig. 4). Oral-pharyngeal (Avian Influenza) and cloacal (West Nile Virus) swabs were also collected following procedures established by the U.S.G.S. National Wildlife Health Laboratory (*http://www.nwhc.usgs.gov/disease_information/avian_influenza/2007%20NWHC%20Protocol%20Combined%20OP%20&%20CL%20Swabs%20v5-29-07.pdf*; Fig. 4). To ensure the well-being of field biologists, we followed recommendations for human health safety practices established by the U.S.G.S. Bird Banding Laboratory in conjunction with the Centers for Disease Control and Prevention (*http://www.doi.gov/issues/appendixOHSguidanceforAvian%20Influenza12-18.pdf* and *http://www.nwhc.usgs.gov/publications/wildlife_health_bulletins/WHB_05_03.jsp*). All ravens were banded prior to release (Fig. 5).



A) *B)*

Figure 4. Collecting biological samples from a Chihuahuan raven captured at the Sierra Blanca, Texas landfill. A) Drawing blood for environmental contaminants. B) Swabbing cloaca for West Nile Virus.

Laboratory analyses of environmental contaminants (heavy metals, OCs, PCBs) and cholinesterase activity (to assess organophosphate and carbamate exposure) were conducted in the California Animal Health and Food Safety Laboratory by Dr. Robert Poppenga (University of California-Davis). Metals in blood samples were analyzed after the samples were prepared by Nitric Acid digestion in open vessel heating blocks. After digestion, samples were diluted into another dilute acid solution and analyzed by Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES).

PCBs in blood samples were identified via Arcolor analyses. Arcolors were common commercial mixtures of PCB congeners, and were an appropriate metric for this study, which was in the preliminary stages of risk assessment (Bernhard and Petron 2001). PCBs were first extracted into an ethanol:ethyl acetate solvent mixture, and sample extracts were then run through a Florisil column. PCBs were identified according to Aroclor mixture. Identification was made by comparing chromatograms of sample extracts with the chromatograms produced by standards. Analyses were performed utilizing Gas Chromatography coupled with a Mass Selective Detector.

Figure 5. Marking a Chihuahuan raven with a U.S. Geological Service band prior to release.

PCBs were not detected in any samples from 2007, so in 2008-2009 we had the laboratory screen for a number of organochlorines pesticides (Appendix, Table 1). Organochlorine pesticide sample preparation, for serum or plasma samples, consisted of liquid/solid extraction using solid phase extraction (SPE) cartridges after the addition of urea to each sample. Isotopically labeled internal standards were added to each sample. Organochlorine pesticides were then analyzed using gas chromatography with mass spectrometric detection (GC-MSD) and quantitated by isotope dilution.

Cholinesterase in blood serum was analyzed by the classic Ellman method, which is an enzyme kinetic, spectrophotometric method. Cholinesterase enzyme present in the sample hydrolyzed acetylthiocholine to thiocholine. Thiocholine reacted with 5,5'-dithiobis-2-nitrobenzoic acid (DTNB) to produce a yellow color. The rate of color production was measured at 405 nm using a Microplate Reader. Activity of the cholinesterase was expressed in micromoles of acetylthiocholine hydrolyzed per mL (blood) of sample per minute.

Oral-pharyngeal swab samples were collected to monitor Avian Influenza (H5 and H7 subtypes) in collaboration with Dr. Flint Taylor of the New Mexico Department of Agriculture's Veterinary Diagnostic Services (Albuquerque). Because of the very low probability of detecting Avian Influenza, samples were pooled into groups of five for analyses. A PCR assay was run to detect either H5 or H7 subtypes within pooled samples.

Cloacal swabs (PCR test) and blood samples (for ELISA antibody tests) were sent to Dr. Jeanne Fair, Los Alamos National Laboratories, for West Nile Virus analyses. Positive samples were verified with a crow (*C. brachyrhynchos*) from a West Nile Virus infection study at Colorado State University.

With the exception of selenium, environmental contaminants were detected in fewer than 50% of raven samples (range 0-34%, depending on the analysis). Therefore, I followed the statistical guidelines of Helsel (1990:1772) and have presented only summary statistics.

RESULTS and DISCUSSION

My field assistants and I began surveys for raven nests in April 2007, one month after contract paperwork had been approved by CEHMM and St. Cloud State University. All field work was completed by August 2009. In general, we surveyed the extensive study area in sections, focusing on specific areas during specific years, generally working from east (Hobbs and Eunice, NM) to west (Dell City, Sierra Blanca and El Paso, TX) (Table 1).

Table 1. General field work schedule. New Mexico study areas included Eunice and the greater Carlsbad region. Texas study areas included the greater Dell City region, Sierra Blanca, and El Paso. Much effort was also expended surveying the Route 62/180 corridor and the I-10 corridor for nestling and congregating adult ravens.

	2007	2008	2009
January			Adult sampling – TX
February			Adult sampling – TX
March	PROJECT START	Nest surveys – TX	Nest survey – TX
April	Nest surveys – NM		Adult sampling – TX
May	Nest surveys – NM		
June	Nestling sampling – NM	Nestling sampling – TX	Nestling sampling – TX
July	Nestling sampling – NM	Nestling sampling – TX	Nestling sampling – TX
August		Adult sampling – TX	Adult sampling – TX
September		Adult sampling – TX	PROJECT END
October			
November	Adult sampling – NM	Adult sampling – TX	
December	Adult sampling – NM	Adult sampling – TX	

We banded 202 ravens (101 nestlings, 101 adults). Number of ravens banded varied by location: Carlsbad ($n = 81$), Eunice ($n = 25$), Dell City ($n = 22$), Sierra Blanca ($n = 48$), and El Paso ($n = 26$). Sixty one ravens were sampled for elements (heavy metals), 44 for OCs, 11 for PCBs, and 65 for cholinesterase. We sampled 180 ravens for West Nile Virus and 170 for Avian Influenza.

All ravens sampled for heavy metals had detectable levels of selenium (Appendix, Table 3). Combining data from 2007-2009, nestling ravens ($n = 14$) had mean ± SE ppm levels representative of background exposure (0.33 ± 03 ppm) (Fig. 6). Adult ravens ($n = 36$) had significantly ($t = 7.21$, $df = 48$, $p < 0.001$; test conducted on log transformed data) higher mean levels (0.85 ± 0.08 ppm), but which were nonetheless relatively low and probably not of concern. Source of selenium found in raven blood remained unknown but probably included the metal dissolving naturally from local soils. Other common sources of selenium in the U.S. that were not observed on the study area were sewage sludge, fly ash, and emissions from smelters. Egg and liver tissue concentrations of selenium were the best predictors of harm to birds (Heinz 1996), but given the low levels currently observed in Chihuahuan ravens, destructive sampling of ravens to analyze eggs or livers is unwarranted.

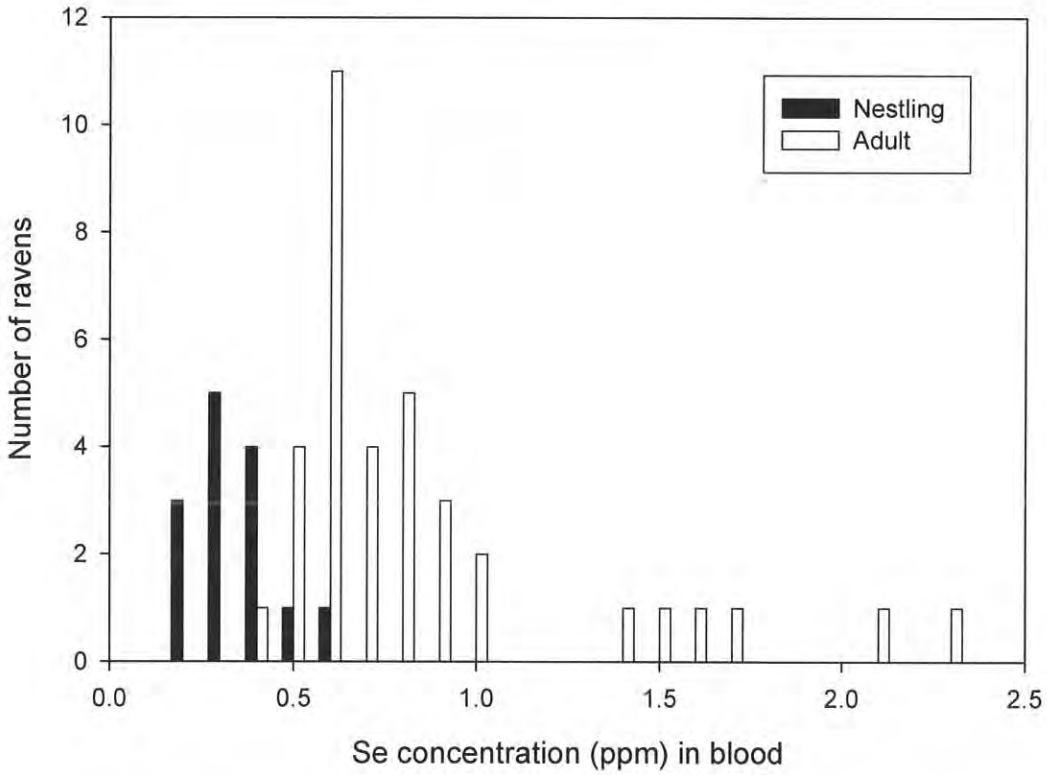


Figure 6. Distribution of selenium (ppm) concentrations in blood by raven age group.

Only 15 of 61 (25%) ravens sampled had detectable levels of lead in blood, and these levels were quite low given toxicity reported in the literature (Franson 1996). Mean ± SE ppm level was 0.11 ± 0.01 (range 0.06 – 0.23 ppm). Only adults had detectable levels. Sources of lead on the study area remained unknown. Recent scientific investigations have focused on the role of lead fragments from bullets and shot in environmental contamination (Fisher et al. 2006). The possibility existed that ravens may have ingested lead by scavenging small game wounded or killed during sport hunting but which went unrecovered in the field.

Mercury was detected in 21 of 61 (34%) ravens sampled, and all levels were very low (range 0.020-0.056 ppm). Mean ± SE ppm level was 0.034 ± 0.003 in blood. As with lead, mercury was detected only in adult ravens. At present, mercury contamination was not of concern.

PCBs within Arcolor mixtures were not detected in either nestling or adult ravens during 2007 and we did not repeat analyses in 2008. Instead, we analyzed 44 raven samples for organochlorine pesticides (Appendix, Table 1). Twelve of 44 (27%) ravens – all adults - had detectable levels of pp-DDE (range 16-270 ppb, mean 77 ± 20 ppb). Pesticide levels were generally low and not of concern. Raw data for all contaminant levels has been provided in Appendix, Tables 3-5.

It will be difficult to ascertain the exact relevance of cholinesterase levels in Chihuahuan ravens in southeastern New Mexico because standards for the species and area have not been established. A laboratory study run in conjunction with this field study would provide interpretative power, but given that cholinesterase activity was generally low (Appendix, Table 6) compared to published values for other species, exposure to organophosphates and carbamates on the study area is low and not of immediate concern.

Despite testing 170 ravens for the H5 and H7 subtypes of Avian Influenza and 180 ravens for West Nile Virus, neither virus detected in nestling or adult ravens from 2007-2009. The result for West Nile Virus was encouraging because over 125 humans tested positive in Texas, including in El Paso county (http://www.dshs.state.tx.us/idcu/disease/arboviral/westNile/), and over 10 humans tested positive for West Nile Virus in several southern counties of New Mexico (http://www.health.state.nm.us/epi/wnv.html).

In conclusion, none of the contaminant levels reported from this study are of environmental concern despite the extensive sampling we conducted both across the study area and within specific regions considered at risk to pollution (e.g., El Paso). It is difficult to generalize the findings from other studies conducted along the Texas – Mexico border; some found high levels of environmental contaminants (e.g., Mora et al. 2006), whereas others did not (e.g., Fredricks et al. 2009). Therefore, it might be prudent to continue sampling, but only at 3-5 year intervals. Missing from our study is a determination of raven habitat use, thus collecting data of raven movements via telemetry would provide additional insight into linkages between Texas and Mexico.

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Appendix
(Tables 1-6)

Table 1. List of screened organochlorines pesticides.

Analyte	Reporting Limit (ppb except op-DDE)
alpha-BHC	5
HCB (hexachlorobenzene)	5
bamma-BHC (Lindane)	5
Heptachlor	5
Aldrin	5
Dicofol	5
Heptachlor Epoxide	5
op-DDE (ppm)	10
Chlordane (cis and trans)	5
Endosulfan I	5
trans-Nonachlor	5
Dieldrin	5
pp-DDE	10
op-DDD	10
Endrin	5
op-DDT	10
cis-Nonachlor	5
pp-DDD	5
pp-DDT	10
Methoxychlor	10
Mirex	5

Table 2. Summary of banding data of Chihuahuan ravens in New Mexico and Texas, 2007-2009.

Band number	Sampling location	Sampling date	Zone	UTM E	UTM N
1045-79001	Nest 47	31-May-07	13 S	628377	3630333
1045-79002	Nest 47	31-May-07	13 S	628377	3630333
1045-79003	Nest 47	31-May-07	13 S	628377	3630333
1045-79004	Nest 47	31-May-07	13 S	628377	3630333
1045-79005	Nest 47	31-May-07	13 S	628377	3630333
1045-79006	Nest 47	31-May-07	13 S	628377	3630333
1045-79007	Nest 8	26-Jun-07	13 S	607642	3599390
1045-79008	Nest 8	26-Jun-07	13 S	607642	3599390
1045-79009	Nest 8	26-Jun-07	13 S	607642	3599390
1045-79010	Nest 8	26-Jun-07	13 S	607642	3599390
1045-79011	Nest 8	26-Jun-07	13 S	607642	3599390
1045-79012	Nest 13	26-Jun-07	13 S	634101	3601172
1045-79013	Nest 13	26-Jun-07	13 S	634101	3601172
1045-79014	Nest 13	26-Jun-07	13 S	634101	3601172
1045-79015	Nest 13	26-Jun-07	13 S	634101	3601172
1045-79016	Nest 13	26-Jun-07	13 S	634101	3601172
1045-79017	Nest 5	26-Jun-07	13 S	633962	3601455
1045-79018	Nest 5	26-Jun-07	13 S	633962	3601455
1045-79019	Nest 5	26-Jun-07	13 S	633962	3601455
1045-79020	Nest 47	26-Jun-07	13 S	633962	3601455
1045-79021	Nest 16	27-Jun-07	13 S	633817	3600100
1045-79022	Nest 16	27-Jun-07	13 S	633817	3600100
1045-79023	Nest 16	27-Jun-07	13 S	633817	3600100
1045-79024	Nest 16	27-Jun-07	13 S	633817	3600100
1045-79025	Nest 10	27-Jun-07	13 S	628880	3597491
1045-79026	Nest 10	27-Jun-07	13 S	628880	3597491
1045-79027	Nest 10	27-Jun-07	13 S	628880	3597491
1045-79028	Nest 9	27-Jun-07	13 S	630378	3601918
1045-79029	Nest 9	27-Jun-07	13 S	630378	3601918
1045-79030	Nest 9	27-Jun-07	13 S	630378	3601918
1045-79031	Nest 30	29-Jun-07	13 S	615668	3641509
1045-79032	Nest 30	29-Jun-07	13 S	615668	3641509
1045-79033	Nest 32	29-Jun-07	13 S	614514	3641957
1045-79034	Nest 32	29-Jun-07	13 S	614514	3641957
1045-79035	Nest 32	29-Jun-07	13 S	614514	3641957
1045-79036	Nest 32	29-Jun-07	13 S	614514	3641957
1045-79037	Nest 34	29-Jun-07	13 S	614135	3641817
1045-79038	Nest 34	29-Jun-07	13 S	614135	3641817
1045-79039	Nest 55	30-Jun-07	13 S	612827	3648400
1045-79040	Nest 55	30-Jun-07	13 S	612827	3648400

1045-79041	Nest 55	30-Jun-07	13 S	612827	3648400
1045-79042	Nest 35	30-Jun-07	13 S	617253	3642221
1045-79043	Nest 35	30-Jun-07	13 S	617253	3642221
1045-79044	Nest 35	30-Jun-07	13 S	617253	3642221
1045-79045	Nest 35	30-Jun-07	13 S	617253	3642221
1045-79046	Nest 35	30-Jun-07	13 S	617253	3642221
1045-79047	Nest 44	01-Jul-07	13 S	618868	3640611
1045-79048	Nest 44	01-Jul-07	13 S	618868	3640611
1045-79049	Nest 58	01-Jul-07	13 S	617931	3640637
1045-79050	Nest 16	27-Jun-07	13 S	633817	3600100
1045-79051	Nest 32	29-Jun-07	13 S	614514	3641957
1045-79052	Nest 55	30-Jun-07	13 S	612827	3648400
1045-79053	Nest 44	01-Jul-07	13 S	618868	3640611
1045-79054	Nest 58	01-Jul-07	13 S	617931	3640637
1045-79055	Nest 37	01-Jul-07	13 S	617931	3640637
1045-79056	Nest 36	01-Jul-07	13 S	617737	3641166
1045-79057	Nest 20	02-Jul-07	13 S	629933	3601037
1045-79058	Nest 22	02-Jul-07	13 S	629011	3601367
1045-79059	Nest 23	02-Jul-07	13 S	627066	3600657
1045-79060	Nest 61	04-Jul-07	13 S	648988	3617613
1045-79061	Nest 64	04-Jul-07	13 S	664622	3614918
1045-79062	Nest 67	06-Jul-07	13 S	657028	3593932
1045-79063	Eunice, NM landfill	09-Nov-07	13 S	681024	3589533
1045-79064	Eunice, NM landfill	09-Nov-07	13 S	681024	3589533
1045-79065	Eunice, NM landfill	10-Nov-07	13 S	681024	3589533
1045-79066	Eunice, NM landfill	10-Nov-07	13 S	681024	3589533
1045-79067	Eunice, NM landfill	10-Nov-07	13 S	681024	3589533
1045-79068	Eunice, NM landfill	10-Nov-07	13 S	681024	3589533
1045-79069	Eunice, NM landfill	10-Nov-07	13 S	681024	3589533
1045-79070	Eunice, NM landfill	10-Nov-07	13 S	681024	3589533
1045-79071	Nest 37	01-Jul-07	13 S	617931	3640637
1045-79072	Nest 37	01-Jul-07	13 S	617931	3640637
1045-79073	Nest 36	01-Jul-07	13 S	617737	3641166
1045-79074	Nest 36	01-Jul-07	13 S	617737	3641166
1045-79075	Nest 36	01-Jul-07	13 S	617737	3641166
1045-79076	Nest 20	02-Jul-07	13 S	629933	3601037
1045-79077	Nest 20	02-Jul-07	13 S	629933	3601037
1045-79078	Nest 22	02-Jul-07	13 S	629011	3601367
1045-79079	Nest 22	02-Jul-07	13 S	629011	3601367
1045-79080	Nest 23	02-Jul-07	13 S	627066	3600657
1045-79081	Nest 23	02-Jul-07	13 S	627066	3600657
1045-79082	Nest 61	04-Jul-07	13 S	648988	3617613
1045-79083	Nest 61	04-Jul-07	13 S	648988	3617613

1045-79084	Nest 64	04-Jul-07	13 S	664622	3614918
1045-79085	Nest 64	04-Jul-07	13 S	664622	3614918
1045-79086	Nest 67	06-Jul-07	13 S	657028	3593932
1045-79087	Nest 67	06-Jul-07	13 S	657028	3593932
1045-79088	Nest 68	06-Jul-07	13 S	653838	3593864
1045-79089	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79090	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79091	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79092	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79093	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79094	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79095	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79096	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79097	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79098	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79099	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79100	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79101	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79102	Eunice, NM landfill	28-Dec-07	13 S	681024	3589533
1045-79103	Eunice, NM landfill	28-Dec-07	13 S	681024	3589533
1045-79104	Eunice, NM landfill	28-Dec-07	13 S	681024	3589533
1045-79105	Nest 1	29-Jun-08	13R	421553	3523609
1045-79106	Sierra Blanca, TX Landfill	30-Jun-08	13R	465510	3443475
1045-79107	Sierra Blanca, TX Landfill	30-Jun-08	13R	465510	3443475
1045-79108	Sierra Blanca, TX Landfill	30-Jun-08	13R	465510	3443475
1045-79109	Sierra Blanca, TX Landfill	30-Jun-08	13R	465510	3443475
1045-79110	Eunice, NM landfill	27-Dec-07	13 S	681024	3589533
1045-79111	Sierra Blanca, TX Landfill	30-Jun-08	13R	465510	3443475
1045-79112	Sierra Blanca, TX Landfill	30-Jun-08	13R	465510	3443475
1045-79113	Sierra Blanca, TX Landfill	30-Jun-08	13R	465510	3443475
1045-79114	Sierra Blanca, TX Landfill	30-Jun-08	13R	465510	3443475
1045-79115	Sierra Blanca, TX Landfill	30-Jun-08	13R	465510	3443475
1045-79116	Nest 2	01-Jul-08	13R	460294	3515056
1045-79117	Nest 2	01-Jul-08	13R	460294	3515056
1045-79118	Sierra Blanca, TX Landfill	02-Jul-08	13R	465510	3443475
1045-79119	Sierra Blanca, TX Landfill	02-Jul-08	13R	465510	3443475
1045-79120	Sierra Blanca, TX Landfill	02-Jul-08	13R	465510	3443475
1045-79121	Sierra Blanca, TX Landfill	02-Jul-08	13R	465510	3443475
1045-79122	Sierra Blanca, TX Landfill	02-Jul-08	13R	465510	3443475
1045-79123	Sierra Blanca, TX Landfill	02-Jul-08	13R	465510	3443475
1045-79124	Sierra Blanca, TX Landfill	02-Jul-08	13R	465510	3443475
1045-79125	Sierra Blanca, TX Landfill	02-Jul-08	13R	465510	3443475
1045-79126	Sierra Blanca, TX Landfill	02-Jul-08	13R	465510	3443475

1045-79127	El Paso, TX City Park	08-Dec-08	13R	374773	3502106
1045-79128	El Paso, TX City Park	08-Dec-08	13R	374773	3502106
1045-79129	El Paso, TX City Park	08-Dec-08	13R	374773	3502106
1045-79130	El Paso, TX City Park	08-Dec-08	13R	375386	3502230
1045-79131	El Paso, TX City Park	08-Dec-08	13R	375386	3502230
1045-79132	El Paso, TX City Park	08-Dec-08	13R	375386	3502230
1045-79133	El Paso, TX City Park	08-Dec-08	13R	375386	3502230
1045-79134	El Paso, TX City Park	08-Dec-08	13R	375386	3502230
1045-79135	El Paso, TX City Park	08-Dec-08	13R	375386	3502230
1045-79136	El Paso, TX City Park	08-Dec-08	13R	375386	3502230
1045-79137	El Paso, TX City Park	09-Dec-08	13R	375386	3502230
1045-79138	El Paso, TX City Park	09-Dec-08	13R	375386	3502230
1045-79139	El Paso, TX City Park	09-Dec-08	13R	375386	3502230
1045-79140	El Paso, TX City Park	09-Dec-08	13R	375386	3502230
1045-79141	El Paso, TX City Park	09-Dec-08	13R	375386	3502230
1045-79142	El Paso, TX City Park	09-Dec-08	13R	375386	3502230
1045-79143	El Paso, TX City Park	09-Dec-08	13R	374773	3502106
1045-79144	El Paso, TX City Park	09-Dec-08	13R	374773	3502106
1045-79145	El Paso, TX City Park	09-Dec-08	13R	374773	3502106
1045-79146	El Paso, TX City Park	29-Jan-09	13R	374773	3502106
1045-79147	El Paso, TX City Park	29-Jan-09	13R	374773	3502106
1045-79148	El Paso, TX City Park	31-Jan-09	13R	374773	3502106
1045-79149	El Paso, TX City Park	31-Jan-09	13R	374773	3502106
1045-79150	El Paso, TX City Park	31-Jan-09	13R	374773	3502106
1045-79151	El Paso, TX City Park	31-Jan-09	13R	374773	3502106
1045-79152	El Paso, TX City Park	01-Feb-09	13R	374773	3502106
1045-79153	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79154	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79155	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79156	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79157	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79158	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79159	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79160	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79161	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79162	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79163	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79164	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79165	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79166	Sierra Blanca, TX Landfill	09-Apr-09	13R	465510	3443475
1045-79167	Sierra Blanca, TX Landfill	10-Apr-09	13R	465510	3443475
1045-79168	Sierra Blanca, TX Landfill	10-Apr-09	13R	465510	3443475
1045-79169	Sierra Blanca, TX Landfill	10-Apr-09	13R	465510	3443475

1045-79170	Sierra Blanca, TX Landfill	10-Apr-09	13R	465510	3443475
1045-79171	Sierra Blanca, TX Landfill	10-Apr-09	13R	465510	3443475
1045-79172	Sierra Blanca, TX Landfill	10-Apr-09	13R	465510	3443475
1045-79173	Sierra Blanca, TX Landfill	10-Apr-09	13R	465510	3443475
1045-79174	Sierra Blanca, TX Landfill	10-Apr-09	13R	465510	3443475
1045-79175	Sierra Blanca, TX Landfill	10-Apr-09	13R	465510	3443475
1045-79176	Sierra Blanca, TX Landfill	10-Apr-09	13R	465510	3443475
1045-79177	Sierra Blanca, TX Landfill	10-Apr-09	13R	465510	3443475
1045-79178	Sierra Blanca, TX Landfill	11-Apr-09	13R	465510	3443475
1045-79179	Sierra Blanca, TX Landfill	11-Apr-09	13R	465510	3443475
1045-79180	Sierra Blanca, TX Landfill	11-Apr-09	13R	465510	3443475
1045-79181	Sierra Blanca, TX Landfill	11-Apr-09	13R	465510	3443475
1045-79182	Sierra Blanca, TX Landfill	11-Apr-09	13R	465510	3443475
1045-79183	Nest 1	27-Jun-09	13R	438725	3519611
1045-79184	Nest 1	28-Jun-09	13R	438725	3519611
1045-79185	Nest 1	28-Jun-09	13R	438725	3519611
1045-79186	Nest 1	28-Jun-09	13R	438725	3519611
1045-79187	Nest 1	28-Jun-09	13R	438725	3519611
1045-79188	Nest 2	28-Jun-09	13R	443425	3518668
1045-79189	Nest 3	28-Jun-09	13R	433583	3520716
1045-79190	Nest 3	28-Jun-09	13R	433583	3520716
1045-79191	Nest 4	30-Jun-09	13R	446186	3516187
1045-79192	Nest 4	30-Jun-09	13R	446186	3516187
1045-79193	Nest 4	30-Jun-09	13R	446186	3516187
1045-79194	Nest 5	02-Jul-09	13R	459672	3515207
1045-79195	Nest 6	02-Jul-09	13R	433583	3520716
1045-79196	Nest 6	02-Jul-09	13R	433583	3520716
1045-79197	Nest 6	02-Jul-09	13R	433583	3520716
1045-79198	Nest 6	02-Jul-09	13R	433583	3520716
1045-79199	Nest 7	02-Jul-09	13R	438355	3519938
1045-79200	Nest 7	02-Jul-09	13R	438355	3519938
1095-07901	Nest 7	02-Jul-09	13R	438355	3519938
wpt.80 #3	Nest 35	30-Jun-07	13 S	617253	3642221

Table 3. Element concentrations measured in blood of Chihuahuan ravens in New Mexico and Texas, 2007-2009.

Band number	Sample location	Age	Lead (ppm)	Mercury (ppm)	Selenium (ppm)
1045-79050	Nest 16 - 2007	Nestling	ND[1]	ND	0.39
1045-79051	Nest 32 - 2007	Nestling	ND	ND	0.26
1045-79052	Nest 55 - 2007	Nestling	ND	ND	0.27
1045-79053	Nest 44 - 2007	Nestling	ND	ND	0.27
1045-79054	Nest 58 - 2007	Nestling	ND	ND	0.23
1045-79055	Nest 37 - 2007	Nestling	ND	ND	0.19
1045-79056	Nest 36 - 2007	Nestling	ND	ND	0.30
1045-79057	Nest 20 - 2007	Nestling	ND	ND	0.27
1045-79058	Nest 22 - 2007	Nestling	ND	ND	0.36
1045-79059	Nest 23 - 2007	Nestling	ND	ND	0.35
1045-79060	Nest 61 - 2007	Nestling	ND	ND	0.52
1045-79061	Nest 64 - 2007	Nestling	ND	ND	0.23
1045-79062	Nest 67 - 2007	Nestling	ND	ND	0.36
1045-79063	Eunice, NM Landfill	Adult	0.23	ND	0.86
1045-79064	Eunice, NM Landfill	Adult	0.07	ND	0.64
1045-79065	Eunice, NM Landfill	Adult	ND	ND	0.61
1045-79066	Eunice, NM Landfill	Adult	0.09	ND	1.00
1045-79067	Eunice, NM Landfill	Adult	0.10	ND	0.54
1045-79068	Eunice, NM Landfill	Adult	0.06	ND	0.58
1045-79069	Eunice, NM Landfill	Adult	0.12	ND	0.67
1045-79070	Eunice, NM Landfill	Adult	0.17	ND	0.68
1045-79098	Eunice, NM Landfill	Adult	0.20	0.038	0.80
1045-79100	Eunice, NM Landfill	Adult	0.09	0.055	0.51
1045-79101	Eunice, NM Landfill	Adult	0.21	0.024	0.57
1045-79102	Eunice, NM Landfill	Adult	0.06	0.026	0.78
1045-79103	Eunice, NM Landfill	Adult	ND	ND	0.59
1045-79104	Eunice, NM Landfill	Adult	ND	ND	0.63
1045-79105	Nest 1 - 2008	Nestling	ND	ND	0.56
1045-79106	Sierra Blanca, TX Landfill	Adult	ND	ND	0.56
1045-79107	Sierra Blanca, TX Landfill	Adult	ND	ND	0.99
1045-79108	Sierra Blanca, TX Landfill	Adult	ND	ND	0.86
1045-79109	Sierra Blanca, TX Landfill	Adult	ND	ND	1.50
1045-79110	Eunice, NM Landfill	Adult	ND	ND	0.55
1045-79111	Sierra Blanca, TX Landfill	Adult	ND	ND	0.77
1045-79112	Sierra Blanca, TX Landfill	Adult	ND	ND	0.92
1045-79113	Sierra Blanca, TX Landfill	Adult	ND	ND	2.10
1045-79114	Sierra Blanca, TX Landfill	Adult	0.07	ND	1.40
1045-79115	Sierra Blanca, TX Landfill	Adult	ND	ND	0.77
1045-79116	Nest 2 - 2008	Adult	ND	ND	0.59
1045-79117	Nest 2 - 2008	Adult	ND	ND	0.56
1045-79118	Sierra Blanca, TX Landfill	Adult	ND	ND	2.30
1045-79119	Sierra Blanca, TX Landfill	Adult	ND	ND	0.62
1045-79120	Sierra Blanca, TX Landfill	Adult	ND	ND	0.77
1045-79121	Sierra Blanca, TX Landfill	Adult	ND	ND	0.69
1045-79138	El Paso, TX City Park	Adult	ND	0.02	0.50
1045-79139	El Paso, TX City Park	Adult	ND	0.029	1.60

1045-79141	El Paso, TX City Park	Adult	ND	0.056	0.46
1045-79142	El Paso, TX City Park	Adult	ND	0.025	0.70
1045-79143	El Paso, TX City Park	Adult	0.07	0.021	1.70
1045-79145	El Paso, TX City Park	Adult	0.06	0.021	0.39
1045-79167	Sierra Blanca, TX Landfill	Adult	ND	0.048	--
1045-79168	Sierra Blanca, TX Landfill	Adult	ND	0.056	--
1045-79169	Sierra Blanca, TX Landfill	Adult	ND	0.037	--
1045-79170	Sierra Blanca, TX Landfill	Adult	ND	0.035	--
1045-79171	Sierra Blanca, TX Landfill	Adult	ND	0.056	--
1045-79172	Sierra Blanca, TX Landfill	Adult	ND	0.035	--
1045-79173	Sierra Blanca, TX Landfill	Adult	ND	0.05	--
1045-79174	Sierra Blanca, TX Landfill	Adult	ND	0.032	--
1045-79175	Sierra Blanca, TX Landfill	Adult	0.08	0.029	--
1045-79176	Sierra Blanca, TX Landfill	Adult	ND	0.025	--
1045-79177	Sierra Blanca, TX Landfill	Adult	ND	0.03	--

[1] ND = none detected. Reporting limits: lead (0.06 ppm), mercury (0.005-0.05 ppm), selenium (0.005-0.05 ppm).

Table 4. Sample concentrations of pp-DDE in blood of Chihuahuan ravens in Texas, 2008-2009.

Band number	Sample location	Age	pp-DDE (ppb)
1045-79122	Sierra Blanca, TX Landfill	Adult	ND[1]
1045-79123	Sierra Blanca, TX Landfill	Adult	44.0
1045-79124	Sierra Blanca, TX Landfill	Adult	56.0
1045-79125	Sierra Blanca, TX Landfill	Adult	33.0
1045-79126	Sierra Blanca, TX Landfill	Adult	16.0
1045-79127	El Paso, TX City Park	Adult	ND
1045-79128	El Paso, TX City Park	Adult	ND
1045-79131	El Paso, TX City Park	Adult	ND
1045-79132	El Paso, TX City Park	Adult	ND
1045-79133	El Paso, TX City Park	Adult	92.0
1045-79134	El Paso, TX City Park	Adult	ND
1045-79135	El Paso, TX City Park	Adult	ND
1045-79136	El Paso, TX City Park	Adult	ND
1045-79147	El Paso, TX City Park	Adult	ND
1045-79148	El Paso, TX City Park	Adult	61.0
1045-79149	El Paso, TX City Park	Adult	110.0
1045-79150	El Paso, TX City Park	Adult	ND
1045-79151	El Paso, TX City Park	Adult	ND
1045-79167	Sierra Blanca, TX Landfill	Adult	ND
1045-79169	Sierra Blanca, TX Landfill	Adult	ND
1045-79170	Sierra Blanca, TX Landfill	Adult	ND
1045-79171	Sierra Blanca, TX Landfill	Adult	ND
1045-79172	Sierra Blanca, TX Landfill	Adult	ND
1045-79177	Sierra Blanca, TX Landfill	Adult	ND
1045-79178	Sierra Blanca, TX Landfill	Adult	60.0
1045-79179	Sierra Blanca, TX Landfill	Adult	110.0
1045-79180	Sierra Blanca, TX Landfill	Adult	270.0
1045-79183	Nest 1 - 2009	Adult	43.0
1045-79184	Nest 1 - 2009	Nestling	ND
1045-79185	Nest 1 - 2010	Nestling	ND
1045-79186	Nest 1 - 2011	Nestling	ND
1045-79187	Nest 1 - 2012	Nestling	ND
1045-79188	Nest 2 - 2009	Nestling	ND
1045-79189	Nest 3 - 2009	Adult	26.0
1045-79190	Nest 3 - 2010	Nestling	ND
1045-79191	Nest 4 - 2009	Nestling	ND
1045-79192	Nest 4 - 2010	Nestling	ND
1045-79193	Nest 4 - 2011	Nestling	ND
1045-79194	Nest 5 - 2009	Nestling	ND
1045-79195	Nest 6 - 2009	Nestling	ND
1045-79197	Nest 6 - 2010	Nestling	ND
1045-79198	Nest 6 - 2011	Nestling	ND
1045-79199	Nest 7 - 2009	Nestling	ND
1045-07901	Nest 7 - 2010	Nestling	ND

[1] ND = none detected. Reporting limit: 20 ppb.

Table 5. Sample concentrations of PCBs in Arcolor mixtures in Chihuahuan ravens in New Mexico, 2007.

			Arcolor tested						
Band number	Sampling location	Age	1221	1232	1242	1248	1254	1260	1262
1045-79063	Eunice, NM landfill	Adult	ND[1]	ND	ND	ND	ND	ND	ND
1045-79064	Eunice, NM landfill	Adult	ND	ND	ND	ND	ND	ND	ND
1045-79065	Eunice, NM landfill	Adult	ND	ND	ND	ND	ND	ND	ND
1045-79068	Eunice, NM landfill	Adult	ND	ND	ND	ND	ND	ND	ND
1045-79069	Eunice, NM landfill	Adult	ND	ND	ND	ND	ND	ND	ND
1045-79089	Eunice, NM landfill	Adult	ND	ND	ND	ND	ND	ND	ND
1045-79090	Eunice, NM landfill	Adult	ND	ND	ND	ND	ND	ND	ND
1045-79091	Eunice, NM landfill	Adult	ND	ND	ND	ND	ND	ND	ND
1045-79093	Eunice, NM landfill	Adult	ND	ND	ND	ND	ND	ND	ND
1045-79094	Eunice, NM landfill	Adult	ND	ND	ND	ND	ND	ND	ND
1045-79096	Eunice, NM landfill	Adult	ND	ND	ND	ND	ND	ND	ND

1 ND = none detected. Reporting limits: 0.1-0.2 ppb.

Table 6. Cholinesterase activity in blood of Chihuahuan ravens in New Mexico and Texas, 2007-2009.

Band number	Sample location	Age	Cholinesterase (uM/ml/min)[1]
1045-79089	Eunice, NM Landfill	Adult	1.3
1045-79090	Eunice, NM Landfill	Adult	1.7
1045-79091	Eunice, NM Landfill	Adult	1.7
1045-79093	Eunice, NM Landfill	Adult	1.2
1045-79094	Eunice, NM Landfill	Adult	1.2
1045-79096	Eunice, NM Landfill	Adult	1.0
1045-79101	Eunice, NM Landfill	Adult	1.3
1045-79102	Eunice, NM Landfill	Adult	0.8
1045-79104	Eunice, NM Landfill	Adult	1.4
1045-79105	Nest 1 - 2008	Nestling	0.5
1045-79106	Sierra Blanca, TX Landfill	Adult	0.8
1045-79107	Sierra Blanca, TX Landfill	Adult	1.3
1045-79108	Sierra Blanca, TX Landfill	Adult	0.8
1045-79109	Sierra Blanca, TX Landfill	Adult	1.3
1045-79111	Sierra Blanca, TX Landfill	Adult	1.4
1045-79112	Sierra Blanca, TX Landfill	Adult	0.8
1045-79113	Sierra Blanca, TX Landfill	Adult	0.8
1045-79114	Sierra Blanca, TX Landfill	Adult	0.7
1045-79115	Sierra Blanca, TX Landfill	Adult	1.0
1045-79116	Nest 2 - 2008	Adult	0.4
1045-79117	Nest 2 - 2008	Adult	0.9
1045-79118	Sierra Blanca, TX Landfill	Adult	1.5
1045-79119	Sierra Blanca, TX Landfill	Adult	0.7
1045-79120	Sierra Blanca, TX Landfill	Adult	0.5
1045-79121	Sierra Blanca, TX Landfill	Adult	1.0
1045-79122	Sierra Blanca, TX Landfill	Adult	1.0
1045-79123	Sierra Blanca, TX Landfill	Adult	1.3
1045-79124	Sierra Blanca, TX Landfill	Adult	0.9
1045-79125	Sierra Blanca, TX Landfill	Adult	0.9
1045-79126	Sierra Blanca, TX Landfill	Adult	1.3
1045-79127	El Paso, TX City Park	Adult	1.0
1045-79128	El Paso, TX City Park	Adult	1.0
1045-79154	Sierra Blanca, TX Landfill	Adult	1.3
1045-79155	Sierra Blanca, TX Landfill	Adult	1.0
1045-79156	Sierra Blanca, TX Landfill	Adult	1.5
1045-79157	Sierra Blanca, TX Landfill	Adult	0.6
1045-79158	Sierra Blanca, TX Landfill	Adult	0.8
1045-79159	Sierra Blanca, TX Landfill	Adult	1.6
1045-79160	Sierra Blanca, TX Landfill	Adult	0.9
1045-79162	Sierra Blanca, TX Landfill	Adult	0.8
1045-79164	Sierra Blanca, TX Landfill	Adult	1.0
1045-79166	Sierra Blanca, TX Landfill	Adult	1.0
1045-79168	Sierra Blanca, TX Landfill	Adult	0.8
1045-79169	Sierra Blanca, TX Landfill	Adult	1.3
1045-79171	Sierra Blanca, TX Landfill	Adult	1.0
1045-79172	Sierra Blanca, TX Landfill	Adult	1.0

1045-79173	Sierra Blanca, TX Landfill	Adult	1.4
1045-79176	Sierra Blanca, TX Landfill	Adult	0.4
1045-79183	Nest 1 - 2009	Nestling	0.9
1045-79184	Nest 1 - 2009	Nestling	0.8
1045-79185	Nest 1 - 2009	Nestling	0.8
1045-79186	Nest 1 - 2009	Nestling	1.0
1045-79187	Nest 1 - 2009	Nestling	0.8
1045-79188	Nest 2 - 2009	Nestling	0.7
1045-79189	Nest 3 - 2009	Nestling	1.2
1045-79190	Nest 3 - 2009	Nestling	1.3
1045-79191	Nest 4 - 2009	Nestling	0.6
1045-79192	Nest 4 - 2009	Nestling	0.9
1045-79193	Nest 4 - 2009	Nestling	0.5
1045-79194	Nest 5 - 2009	Nestling	0.8
1045-79195	Nest 6 - 2009	Nestling	0.6
1045-79197	Nest 6 - 2009	Nestling	0.8
1045-79198	Nest 6 - 2009	Nestling	0.6
1045-79199	Nest 7 - 2009	Nestling	0.6
1095-07901	Nest 7 - 2009	Nestling	0.7

[1] Reporting limit: 0.1 uM/ml/min.

FINAL TECHNICAL REPORT

DOE Award Number: DE-FG30-05EW03004

Recipient: Center of Excellence for Hazardous Material Management (CEHMM)

Project Title: Develop Programs to Improve Protection of Worker Safety, Human Health, and the Environment

Project Director/Principal Investigator: Douglas C. Lynn, Executive Director

Consortium/Teaming Members: none

Distribution Limitation: none

EXECUTIVE SUMMARY

The Center of Excellence for Hazardous Materials Management (CEHMM) was awarded (grant number DE-FG3O-05EW03004) $1,984,000.00 on September 28, 2005, and added another $1,980,000.00 on September 21, 2006, $1,000,000.00 on April 24, 2008, and $500,000 on May 15, 2009. This grant was used to develop programs to improve protection of worker safety, human health, and the environment.

The primary focus of this grant was the protection of the environment through the development of a renewable feedstock, algae, as a source for biofuel. Algae are a consumer of carbon dioxide rather than a contributor of this gas. Algae ameliorate carbon dioxide levels attributable to the burning of fossil fuels like coal and at the same time can be used as a source of fuel.

CEHMM began research on the use of algae as a source for biofuel in 2006. Initial studies entailed the analysis of a variety of species cultured in aquaria. Subsequently, those species most robust and with a relatively high lipid content were grown outdoors in small open tanks to assess their viability outside the laboratory. Based on these outdoor tests two 1/8-acre open raceway ponds were constructed beginning in late 2007 and became fully operational in the spring of 2008. A marine alga monoculture was successfully grown year around, and data were collected daily by pond from the time of inoculation. This database is a treasure trove of information regarding chemical, biological and physical parameters which reflect the success of these outdoor cultures. CEHMM has successfully developed and implemented one of a kind crop protection techniques, at commercial scale, to address predation and infestation as well as a nutrient feeding regime, all of which now constitute trade secrets. CEHMM experimented with a variety of harvesting techniques, the results of which have been documented. Finally, a pilot plant extraction facility was built at the CEHMM algae pond facility. CEHMM can grow and harvest algae, concentrate this alga to a level compatible with the extraction equipment and operate the extraction plant to generate algae oil from the lipids found in the CEHMM algae culture. There are now three ¼-acre open raceway ponds and the two original 1/8-acre pond in which the CEHMM marine alga is grown. CEHMM has demonstrated the ability to grow and harvest year-around with consistent biomass production rates exceeding two tons per month per acre.

An economic model has been developed in consultation and collaboration with New Mexico State University and Sandia National Laboratories. This model suggests that a commercial facility based on the CEHMM paradigm is very economically feasible.

Algal oil derived at the CEHMM algal facility can be converted into biodiesel. The rural setting of the CEHMM facility means biodiesel produced in quantity could potentially compete with petroleum diesel in the agricultural market. In addition to fuel, the residual biomass created by the extraction process holds promise in the areas of food supplements for livestock, nutraceutical applications and a protein source.

PROJECT SUMMARY

Goals and Objectives:

Critical success factors of the algae biofuels project are:

(1) Ability to grow and harvest a volume of algae to make sufficient quantity of algae oil and hence biofuels so the product is competitive with petroleum diesel.

Algae oil has been produced and analyzed. This oil can be converted to biodiesel using published techniques. CEHMM is seeking private investment capital to develop a commercial facility based on the experiences at our algal site.

(2) Maintenance of sufficient lipid content in the algal cultures to make the whole process economically competitive;

The CEHMM alga has been analyzed by SRS, Inc., the supplier of our extraction equipment, and found to be the most consistent alga with high lipid content. SRS, Inc. has honed their extraction process based on the CEHMM algae.

(3) Adequate pond acreage needed to support a commercial demonstration scale;

Subsequent to the construction of the first two 1/8-acre ponds, a third ¼-acre pond was built after a ground water permit modification was received from the State of New Mexico. That pond was inoculated in 2009. A second permit modification from the State was obtained in 2010 to add twenty additional ¼-acre ponds at the CEHMM site. To date two new ¼-acre ponds have been built and are in the process of being inoculated. This brings the total number of ponds to five with the promise of many more. The quantity of feedstock produced is the limiting factor in the production of algal oil, i.e., the more algae feedstock available, the more oil produced.

(4) Use of residual biomass as a source of protein, animal feed additive or a basis for the development of nutraceuticals.

An independent laboratory, Eurofins, evaluated the residual biomass generated after the lipid is removed. This analysis suggests that all the proposed goals for biomass use contained in the CEHMM original grant proposal can and will be met.

Project Activities:

Open raceway ponds have been built, ancillary equipment such as paddles and aerators have been installed, and a marine monoculture grown in these ponds for over two years. All of the preliminary objectives have been met. The final piece was the installation of an experimental extraction unit in 2009. This unit has produced algae oil which has been converted to biodiesel in the laboratories of SRS, Inc., the manufacturer of the extraction plant. Figure 1 shows one of

the ¼- acre ponds in the foreground and buildings which house the proprietary extraction equipment in the back.

Figure 1. CEHMM outdoor raceway pond and buildings which house extraction equipment

The CEHMM approach was the use of open raceway ponds to cultivate the algae as opposed to photo-bioreactors. Data collected on a daily basis substantiate the claim that the CEHMM marine alga can be grown on a continuous basis in an outdoor setting.

A variety of harvesting techniques were investigated during the grant period. The time at which algae harvest is initiated depends on a variety of factors. The health of the culture as measured by certain biological and chemical factors is important. Our experience has found that during periods of high growth, the algae ponds do best if the level of harvest is increased.

Routine samples are taken and evaluated microscopically to assess levels of predation and presence of invaders. Techniques have been developed to address these issues. The fact that the alga being cultured is marine and there are no naturally occurring marine waters nearby is a buffer against most predation or invasion.

The vitality of the culture is typically measured by turbidity and photo-optics. The higher the turbidity, the more robust the culture and the greater the need to harvest.

The three harvesting techniques tested at the CEHMM site included chemical flocculation, concentration of algal biomass using hollow tube membrane technology and a standard centrifuge. The results of these approaches are illustrated in the graphs below.

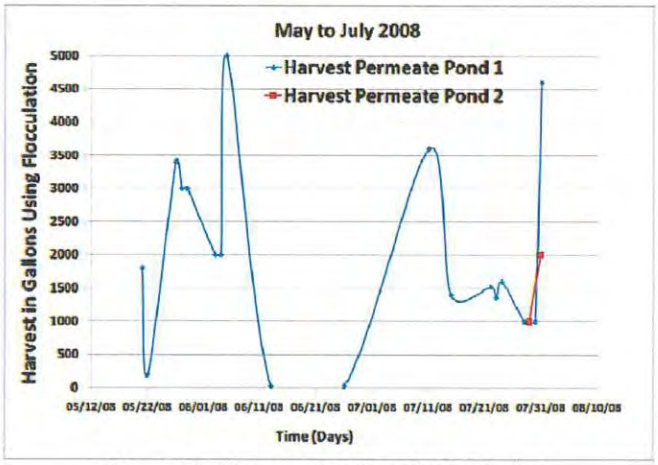

Figure 2. Harvesting by Flocculation

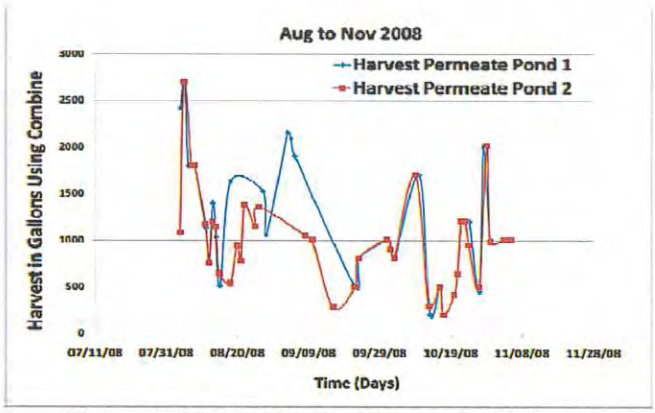

Figure 3. Harvesting by Mechanical Means

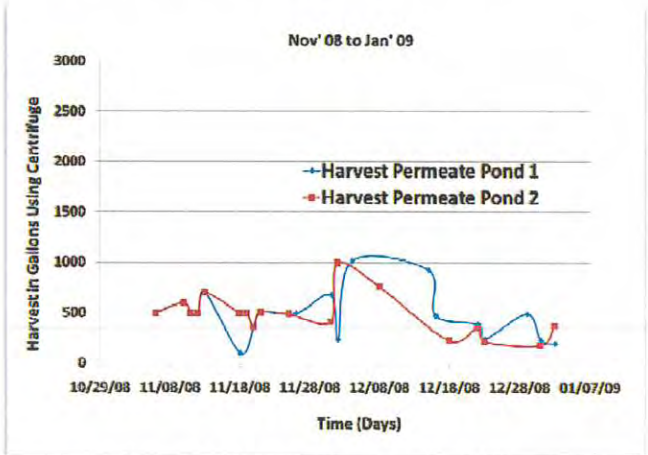

Figure 4. Harvesting by Centrifuge

Currently, CEHMM uses a centrifuge to attain an algae concentration adequate for the extraction equipment. CEHMM continues to experiment with flocculation as a cheaper and less energy intensive alternative. Flocculation, even as a pre-treatment prior to the use of a centrifuge, will cut down the time the centrifuge must run and, hence, reduce the energy required.

CEHMM has successfully extracted oil from algae using the SRS, Inc. equipment. Currently the extraction process is done in batch mode but research is underway to convert the hardware to run continually. Algal oil extracted by this equipment has been converted to biodiesel in small quantities to attain proof of principal. Figure 5 shows containers with algal oil produced by the equipment on which the containers sit.

Figure 5. Algal oil produced at the CEHMM research facility

Products Developed:

CEHMM has developed a website, www.cehmm.org, with information on the projects. Collaborations have been fostered with New Mexico State University, Sandia National Laboratories and SRS, Inc.

CEHMM developed the ability to address predation and infestation in open raceway ponds. A feeding regime was developed which has a positive influence on the growth rate of the algal cultures. CEHMM documented these developments through the design of a database which was written by CEHMM personnel. The feed, the techniques to address predation and infestation, and the ability to maintain a pure culture have been protected through trade secrets.

A database contains all the data gathered on a per pond basis since inoculation. There are some video clips posted on the CEHMM web site which describe project developments. An economic

model based on the CEHMM algal research and development has been authored by Dr. Meghan Starbuck in collaboration with Dr. Amy Sun at Sandia National Laboratories.

One of the components of CEHMM's alternative energy research is to develop a curriculum that is conducive for implementation into public or private school systems at grade levels kindergarten through 12th grade. The curriculum was completed in 2009, is in compliance with state of New Mexico standards and benchmarks, and is ready for implementation in selected test bed schools. This helps to develop student awareness toward applied research and stimulates interest that will motivate students to pursue careers in alternative energy. The local high school is in the process of using algae as a component of their science research requirements. Disciplines such as this will be critical in the development of a future workforce for the emergence of this national agenda for alternative energy.

FINAL TECHNICAL REPORT

DOE Award Number: DE-SC0000581

Recipient: Center of Excellence for Hazardous Material Management (CEHMM)

Project Title: CEHMM Alternative Energy Research and Education

Project Director/Principal Investigator: Douglas C. Lynn, Executive Director

Consortium/Teaming Members: none

Distribution Limitation: none

EXECUTIVE SUMMARY

The Center of Excellence for Hazardous Materials Management (CEHMM) was awarded $1,849,716.00 on June 2, 2009, award number DE-SC0000581. This grant was used for alternative energy research and education.

The primary focus of this grant was the protection of the environment through the development of a renewable feedstock, algae, as a source for biofuel. Algae are a consumer of carbon dioxide rather than a contributor of this gas. Algae ameliorate carbon dioxide levels attributable to the burning of fossil fuels like coal and at the same time can be used as a source of fuel.

CEHMM began research on the use of algae as a source for biofuel in 2006. Initial studies entailed the analysis of a variety of species cultured in aquaria. Subsequently, those species most robust and with a relatively high lipid content were grown outdoors in small open tanks to assess their viability outside the laboratory. Based on these outdoor tests two 1/8-acre open raceway ponds were constructed beginning in late 2007 and became fully operational in the spring of 2008. A marine alga monoculture was successfully grown year around, and data were collected daily by pond from the time of inoculation. This database is a treasure trove of information regarding chemical, biological and physical parameters which reflect the success of these outdoor cultures. CEHMM has successfully developed and implemented one of a kind crop protection techniques, at commercial scale, to address predation and infestation as well as a nutrient feeding regime, all of which now constitute trade secrets. CEHMM experimented with a variety of harvesting techniques, the results of which have been documented. Finally, a pilot plant extraction facility was built at the CEHMM algae pond facility. CEHMM can grow and harvest algae, concentrate this alga to a level compatible with the extraction equipment and operate the extraction plant to generate algae oil from the lipids found in the CEHMM algae culture. There are now three ¼-acre open raceway ponds and the two original 1/8-acre pond in which the CEHMM marine alga is grown. CEHMM has demonstrated the ability to grow and harvest year-around with consistent biomass production rates exceeding two tons per month per acre.

An economic model has been developed in consultation and collaboration with New Mexico State University and Sandia National Laboratories. This model suggests that a commercial facility based on the CEHMM paradigm is very economically feasible.

Algal oil derived at the CEHMM algal facility can be converted into biodiesel. The rural setting of the CEHMM facility means biodiesel produced in quantity could potentially compete with petroleum diesel in the agricultural market. In addition to fuel, the residual biomass created by the extraction process holds promise in the areas of food supplements for livestock, nutraceutical applications and a protein source.

PROJECT SUMMARY

Goals and Objectives:

Critical success factors of the algae biofuels project are:

(1) Ability to grow and harvest a volume of algae to make sufficient quantity of algae oil and hence biofuels so the product is competitive with petroleum diesel.

Algae oil has been produced and analyzed. This oil can be converted to biodiesel using published techniques. CEHMM is seeking private investment capital to develop a commercial facility based on the experiences at our algal site.

(2) Maintenance of sufficient lipid content in the algal cultures to make the whole process economically competitive;

The CEHMM alga has been analyzed by SRS, Inc., the supplier of our extraction equipment, and found to be the most consistent alga with high lipid content. SRS, Inc. has honed their extraction process based on the CEHMM algae.

(3) Adequate pond acreage needed to support a commercial demonstration scale;

Subsequent to the construction of the first two 1/8-acre ponds, a third ¼-acre pond was built after a ground water permit modification was received from the State of New Mexico. That pond was inoculated in 2009. A second permit modification from the State was obtained in 2010 to add twenty additional ¼-acre ponds at the CEHMM site. To date two new ¼-acre ponds have been built and are in the process of being inoculated. This brings the total number of ponds to five with the promise of many more. The quantity of feedstock produced is the limiting factor in the production of algal oil, i.e., the more algae feedstock available, the more oil produced.

(4) Use of residual biomass as a source of protein, animal feed additive or a basis for the development of nutraceuticals.

An independent laboratory, Eurofins, evaluated the residual biomass generated after the lipid is removed. This analysis suggests that all the proposed goals for biomass use contained in the CEHMM original grant proposal can and will be met.

Project Activities:

Open raceway ponds have been built, ancillary equipment such as paddles and aerators have been installed, and a marine monoculture grown in these ponds for over two years. All of the preliminary objectives have been met. The final piece was the installation of an experimental extraction unit in 2009. This unit has produced algae oil which has been converted to biodiesel in the laboratories of SRS, Inc., the manufacturer of the extraction plant. Figure 1 shows one of

the ¼- acre ponds in the foreground and buildings which house the proprietary extraction equipment in the back.

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A variety of harvesting techniques were investigated during the grant period. The time at which algae harvest is initiated depends on a variety of factors. The health of the culture as measured by certain biological and chemical factors is important. Our experience has found that during periods of high growth, the algae ponds do best if the level of harvest is increased.

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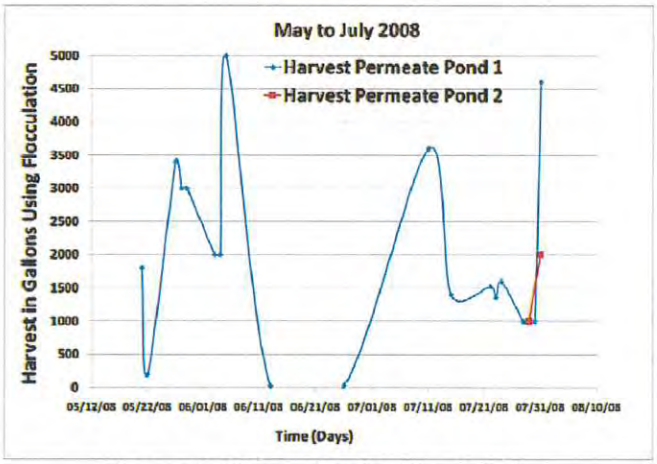

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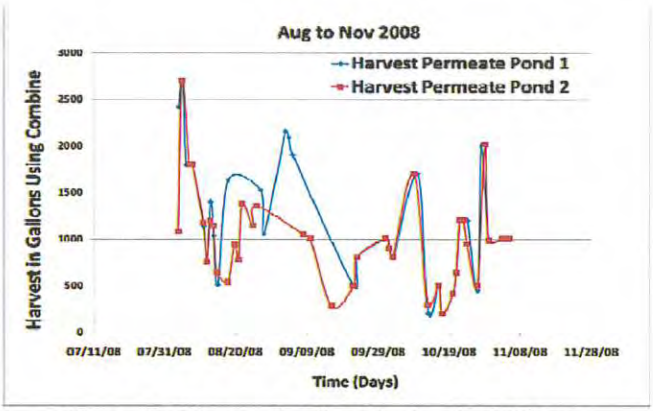

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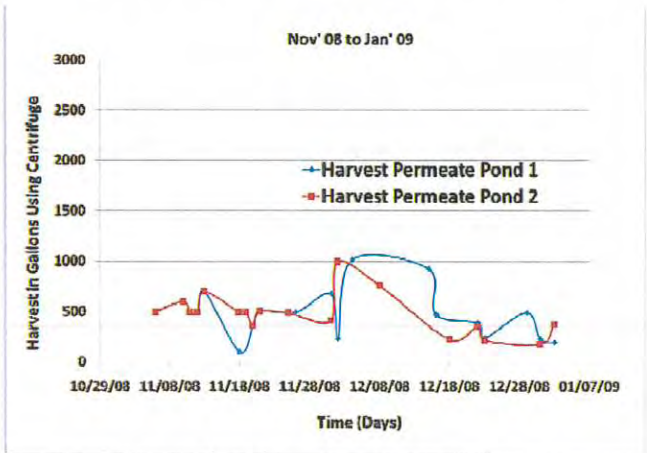

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FINAL TECHNICAL REPORT

DOE Award Number: DE-SC0005319

Recipient: Center of Excellence for Hazardous Material Management (CEHMM)

Project Title: Center of Excellence for Hazardous Materials Management (CEHMM) Algae to Biodiesel Project

Project Director/Principal Investigator: Douglas C. Lynn, Executive Director

Consortium/Teaming Members: none

Distribution Limitation: none

Executive Summary:

The Center of Excellence for Hazardous Materials Management (CEHMM) was awarded $729,000.00 on September 15, 2010, award number DE-SC0005319. This grant was used for alternative energy research.

The CEHMM algae project is a research and development endeavor investigating renewable fuels and a host of high-value co-products from the propagation, harvesting, and extraction of oil from algae. Use of algae as renewable fuel feedstock complementary to petroleum diesel, has great potential to make fuels and a host of valuable co-products, thereby reducing American dependence on foreign oil, sequestering carbon (*Algae are a consumer of carbon dioxide rather than a contributor of this gas. Algae ameliorate carbon dioxide levels attributable to the burning of fossil fuels.)*, and providing attractive, multi market returns for potential investors from profitable operations, tax incentives and positive public relations. This project is a green energy project thereby supporting the national agenda of a clean and renewable source of energy and will not compete with traditional food crops.

Starting in early 2006, CEHMM has grown a marine microalga in outdoor raceway ponds and undertaken applied research on methods of farming, harvesting, and extracting oil from algae. As a result of this work, CEHMM has developed a vertically integrated system that has been scaled up from lab and pilot scale to the early stages of commercial demonstration scale production. In 2010 CEHMM became the world's first fully integrated biorefinery. CEHMM's proprietary crop management systems are one of a kind and the first of their kind to demonstrate production and crop protection at scale.

Since the desert southwest has been identified as an ideal area for algae propagation, CEHMM discoveries related to processes for harvesting and extraction of oil from algae has proven the potential to create a strong new industry for the region.

CEHMM began research on the use of algae as a source for biofuel in 2006. Initial studies entailed the analysis of a variety of species cultured in aquaria. Subsequently, those species most robust and with a relatively high lipid content were cultivated outdoors in small open tanks to assess their viability outside the laboratory. Based on these outdoor tests two 25,000 gallon capacity open raceway ponds were constructed beginning in late 2007 and became fully operational in the spring of 2008. A marine alga monoculture was successfully grown year around, and data were collected daily by pond from the time of inoculation. This database provides invaluable information regarding chemical, biological and physical parameters which reflect the success of these outdoor cultures.

CEHMM has successfully developed and implemented one of a kind crop protection techniques, at commercial scale, to address predation and infestation as well as a nutrient feeding regime, all of which now constitute trade secrets. CEHMM experimented with a variety of harvesting techniques, the results of which have been documented.

A pilot plant extraction facility was built at the CEHMM algae pond facility. CEHMM can grow and harvest algae, concentrate this alga to a level compatible with the extraction equipment and operate the extraction plant to generate algae oil from the lipids found in the CEHMM algae culture. There are now three 100,000 gallon capacity open raceway ponds and the two original 25,000 gallon capacity ponds in which the CEHMM marine alga is grown. CEHMM has demonstrated the ability to grow and harvest year-around with consistent biomass production rates exceeding two tons per month per acre.

An economic model was developed in consultation and collaboration with New Mexico State University, Texas A&M University, and Sandia National Laboratories. This model suggests that a commercial facility based on the CEHMM paradigm is very economically feasible.

Triglycerides comprise 80% of the constituents of CEHMM algal oil. These have been successfully converted into biodiesel which was documented during 2010 and 2011 demonstrations operating a diesel vehicle on CEHMM algal based fuel. The remaining 20% algal lipids show tremendous promise in the arena of nutraceutical markets as they are comprised of Omega III phospholipids, predominantly Eicosapentaenoic acid or EPA.

Finally, the rural setting of the CEHMM facility means biodiesel produced in quantity could potentially compete with petroleum diesel in the agricultural market. In addition to fuel, the residual biomass created by the extraction process holds promise in the areas of food supplements for livestock, nutraceutical applications and a protein source.

Goals And Objectives:

The objective of the CEHMM algae to biodiesel project is to determine the viability and feasibility of using algae as a feedstock for commercial biodiesel production.

a. *Maintain and/or increase lipid content in algal cultures – analysis and data collection will determine actions taken to accomplish this.*

   CEHMM has successfully domesticated a strain of wild algae and can manipulate oil contents with proprietary crop protection protocols. During initial cultivation exercises in 2006, oil contents hovered between 11 and 15% content in comparison to ash-free dry weight. Currently, CEHMM can grow the same strain and maintain consistent levels at >35% oil in comparison to ash-free dry weight.

b. *Continue to grow and harvest algae – growth and harvest data will continue to be collected and used to enhance these processes.*

   In the spring of 2011 CEHMM initiated a productivity demonstration which resulted in production levels that exceed both industry predictions and competitors.

c. *Demonstrate fully integrated algae to biodiesel system – growth, harvest, dewatering and extraction will be done in a fully integrated process on CEHMM's test site.*

   In 2010, CEHMM became the industry's first fully integrated biorefinery. In June of 2010, then Congressman Harry Teague performed the ribbon cutting on the refinery. During 2011, CEHMM staff achieved increase in efficiency through optimization of upstream preparation. Additional efficiency and operability protocols were also implemented in the mid-stream extraction process.

d. *Research added value from residual biomass – research into uses of residual biomass to further the competitive nature of algae biodiesel.*

   CEHMM has completed exhaustive research into the use of the residual biomass as a protein source for commercial fish and livestock markets. These include pepsin digestibility, ruminant digestibility, and palatability research.

e. *Research CO2 uptake – use proprietary information to further this research.*

   CEHMM collaborated with Sandia National Lab scientists and engineers in the assessment of pond performance and culture dynamics. Results indicate that one pound of CEHMM algae can sequester two pounds of carbon daily.

f. *Research contaminant effects on the algal cultures cultivated in open race-way ponds - analysis and data collection will determine the outcome.*

   To date, CEHMM has performed the industry's most comprehensive assessment of contaminant effects on open raceway ponds. These resulted in the development and implementation of the industry's only crop protection regime for open raceway ponds

that does not involve the manipulation of pond pH (e.g., spirulina). This crop protection allows for significantly more flexibility in site selection and is extremely cost effective.

g. *Prepare for commercial demonstration – acquire permits, water rights, land and support to move project closer to a commercial realization.*

Preparation for commercial demonstration is complete. A 20-acre tract has been leased for 10 years under a cooperative research plan with the NMSU Ag Science Center in Artesia, New Mexico. The plan is endorsed by the land owners, the Southeast New Mexico Agricultural Research Association, a coop of local farmers who reside in the near vicinity. Appurtenant water rights and permits for operation have been submitted by CEHMM and were approved by the appropriate cognizant agencies.

Project Activities:

CEHMM's facility located at the NMSU Agricultural Science Center near Artesia, NM currently has five algae ponds; two configured to accommodate culture capacities of 25,000 gallons and three designed with maximum capacities of 100,000 gallons (378,500 liters) each.

In FY2011, the extraction process was tailored to handle larger volumes of algal paste in order to maximize the run through capacity of the equipment. The extraction unit personnel increased their daily throughput by increasing production to 2 batches per day from 2-3 batches per week. In less than one year, the staff at CEHMM has managed to exceed the expectations of the SRS AlgalFrac System (extraction unit). The system is maximized to its full capacity and we have proven the concept that this system is flexible enough to accommodate various species of algae. One of our most recent tests was the extraction of lipids from algae that was sent to us from Israel. The algae was received in a sprayed dry form and staff were able to hydrate the algae and extract about 20 liters of oil. The unit proved to be overwhelmingly efficient at removing the algae. The Israel group conveyed that CEHMM had extracted more oil than any other company that had performed similar tests on their algae.

In February, there was a big cold snap that froze everything at the pond site and caused all paddles to shut down due to ponds freezing over and ice accumulation on the paddles. The entire facility was down for a week and a half until temperatures increased enough to repair all paddles and restart ponds. The NMSU Agricultural Science Center reported 87 hours straight of temperatures below freezing, with a low of -7 degrees for some of those days.

Also in February, the farm crew flocked the largest amount of culture in CEHMM history by filling a frac tank to its capacity of 20,000 gallons and successfully flocking the entire culture.

A harvest demonstration on one of the 1/8th acre ponds was conducted in late April and early May. Intense harvest of this pond occurred during a two week period and the viability of algal culture was unaffected. This suggests harvest rates sufficient to supply a commercial facility. A paper based on this two-week demonstration was authored.

With more than 60 days of temperatures over 100 degrees Fahrenheit and no measurable rainfall this year, algal culturing has seen its share of hard times. The increase in air and water temperatures with little to no geothermal cooling has made it hard to culture specific strains of algae in open raceways. These unique weather conditions have opened the opportunity for research involving different strains of algae with high heat tolerance and high lipid production.

A sample was sent to Algae Aviation in which our flocculation/centrifuge method was used to harvest the algae with one other step added which allowed the salt concentration at less than 1% (0.4% according to Algae Aviation). This was a success as our algae was so combustible that it blew up their equipment.

Sampling of the Pecos River continues twice a month with nearly a full year of data collected. Monthly reports based on this sampling are provided to interested parties. Data input from the ponds continues on a weekly basis.

The biomass has been independently analyzed for the percentage of high value lipids. Based on the proprietary results of this analysis, this biomass may have use as an animal feed supplement, source of protein and use in the nutraceutical industry. Specifically, compounds such as beta carotene, essential amino acids (EAA), EPA and other Omega 3s can be extracted from the algal biomass, and these nutraceuticals have considerable value. New fractionation technology is being developed to fractionate these compounds, thus significantly increasing the marketability of the derived co-products in addition to the fuel oils.

CEHMM is also in pursuit of venture capital funds that will fund a private spinoff of CEHMM. The hope is to build 1,000 acres of ponds that could take our current paradigm to a commercial scale. CEHMM has received expressions of interest from several groups and some have already toured the project. Business plans/proformas have been developed and are currently used as part of the CEHMM portfolio to potential investors. Grant DE-SC0005319 provided the wherewithal to pursue this endeavor and provide the mechanism for job creation and industry development for the area.

Products Developed:

a. Publications: "High Frequency Algal Pond Harvest Demonstration: A Proof-of-Principal in Culture Viability under Applied Algal Farm Management and Operations with Methodology Comparisons in the Evaluation and Prediction of Crop Productivity and Yield" disseminated on CEHMM's website.
b. Web site: www.cehmm.org
c. Networks or collaborations fostered: SRS, Sandia National Laboratories
d. Technologies/Techniques: none
e. Inventions/Patent Applications: none
f. Other: none

High Frequency Algal Pond Harvest Demonstration: A Proof-of-Principal in Culture Viability under Applied Algal Farm Management and Operations with Methodology Comparisons in the Evaluation and Prediction of Crop Productivity and Yield

Center of Excellence for Hazardous Materials Management (CEHMM)
Carlsbad, New Mexico

Douglas C. Lynn, Louis A. Ogaard, Ph.D., William L. Foster, Guadalupe L. Carrasco, Charlin M. Vasquez, and Roger D. Simmons

June 2011

This material is based upon work supported by the Department of Energy under Award Number DE-SC0005139.

Abstract

A 25,000 gallon (94,625 liter) capacity open raceway pond (demonstration pond), maintained at 12,000 gallons (45,420 liters) of algal culture, and a 300 gallon (1,135.25 liter) test pond (circular tank) at the CEHMM algae pond site south of Artesia, New Mexico were subjected to an intensive harvest over a two-week period to assess impact on culture viability and product yield. Fifteen hundred gallons or one-eighth the content of the raceway pond was harvested each day for four days followed by three days of rest. Sampling for ash-free dry weight (AFDW), from which algal concentration (g/l) was calculated, occurred daily. The harvest regimen was repeated during a second week with three measurements of AFDW taken daily. Productivity of an algae growth system in open ponds is commonly assessed by areal yield rather than volumetric yield. CEHMM has adopted an agricultural metric in pounds of product per acre-foot of water per time. Therefore, product density was computed by a conversion of pounds per gallon or grams per liter (g/l) to grams per meter squared (g/m^2) per unit of time. To provide a metric consistent with areal yield, a depth of 12" was used to provide the deficient third dimension to the standard.

Maximum pond productivity during the demonstration was 39.6 g/m^2 (25 April 2011) with 29 g/m^2 minimum (29 April 2011). The average daily pond productivity during the demonstration was 33.08 g/m^2. Daily average for cellular recruitment or growth rate required to reinstate harvested inventory for the entire two week demonstration period, including rest days, was 20 g/m^2 based on pond morphology and culture dynamics. This aligns with recruitment rates based on the acre-foot model averages. Crop projections based on current economic models using resident inventory in concert with growth rates provide evidence that a sustainable inventory in support of economic viability is reasonable (>100 acre-foot of culture).

The pond was fed with a nutrient mix twice a week and makeup water consisted of the supernatant produced during flocculation of the harvested sample along with freshwater to maintain proper salinity. The culture tolerated the high rate of harvest and showed no degradation in viability or productivity.

The circular tank, which was 10 inches deep and 93 inches wide with a holding capacity of 300 gallons or 1,136 liters, had $1/8^{th}$ of its volume or precisely 37.5 gallons (141.94 liters) removed each day for five days, followed by two days of rest, and a repeat of the harvest protocol the second week. A mix of 37.5 gallons of fresh and brine water was added to make up the harvested amount and achieve the proper chemistry and water level. The circular tank was fed every day during harvest. Maximum productivity during the test was 31.51 g/m^2, with a minimum of 26.17 g/m^2. Average productivity for the week was 28.7 g/m^2. No significant change in AFDW was observed.

Although the circular tank was only a fraction of the size of the raceway, CEHMM was able to manage the demonstration more precisely with exact quantities of harvest and make up water. CEHMM collated and validated our data from the larger raceway demonstration. Moreover, many "industry leaders" have indicated that 1,000 liters provides data indicative of "commercial' operations (Oilgae, June 07, 2011).

Introduction

The Center of Excellence for Hazardous Materials Management (CEHMM) has operated an outdoor algal pond facility south of Artesia, New Mexico since June 2006. The current facility has five ponds. Two of these are configured to accommodate culture capacities of 25,000 gallons and three designed with maximum capacities of 100,000 gallons (378,500 liters) each. Actual pond volume is currently maintained at approximately half of the full pond capacity.

CEHMM has repeatedly demonstrated proficiency in algal cultivation and crop management. Culture densities have intentionally been driven as high as 1.2 g/l or 46.6 g/m^2 (e.g., 29 March 2011, 13 June 2011). Pond carrying capacities, however, will not maintain this resident density for more than 24 hours before ponds begin responding negatively (e.g, chlorosis) to overcapacity. Protocols require immediate and aggressive harvesting when densities reach >1g/l (39.5 g/m^2).

This exercise was a demonstration, a proof-of-principle that an intense growth and harvest of an outdoor raceway pond would produce sufficient product to support an algae-based commercial scale operation and the demonstration pond would remain viable. For the purpose of this demonstration, a 25,000 gallon capacity pond with 12,000 gallons of active culture in residence was chosen. This pond has a surface footprint of approximately 1/8th acre. CEHMM routinely harvests these ponds year round with resultant biomass used as feedstock for an experimental oil extraction unit designed and built by SRS, Inc. of Dexter, Michigan.

Objective

The purpose of this demonstration project was to assess the resilience and productivity of a pond which was subjected to intense harvesting techniques over a predetermined period in late April and early May 2011.

Methods

A 25,000 gallon capacity demonstration pond, a harvest control pond of identical size and a 300 gallon circular fiberglass holding tank were used to conduct this demonstration. The harvest control pond, which is the other CEHMM 25,000 gallon capacity pond, served as a control. Ash-free dry weights were measured from grab samples collected from this pond. There was no harvest conducted on this pond during the demonstration period (Table 2). The CEHMM ponds are mixed using paddles and air (not CO_2) sparged into the culture twenty-four hours a day, seven days a week.

Figure 1. Twenty-five thousand gallon capacity raceway pond used during the demonstration. A 100,000 gallon capacity raceway can be seen in the background.

As shown in Figure 1, the demonstration pond was maintained at about a 12" depth (approximately 12,000 gallons

of culture). One eighth of the content of the pond was harvested each day for four days followed by three days of rest. The harvested material was pumped into two cone-bottom tanks where thirty-minute mixing period was required after the addition of the flocculant, as shown in Figures 2 through 4.

Figure 2. Cone-bottom tank into which pond culture was harvested.

Figure 3. Addition of flocculation agent.

Figure 4. Flocculation drops algae out of suspension to the bottom and leaves supernatant at the top.

Make-up water consisted of supernatant recovered from harvested material together with fresh water to reestablish pond chemical parameters and maintain consistent water level.

Figure 5. Supernatant returned to source pond.

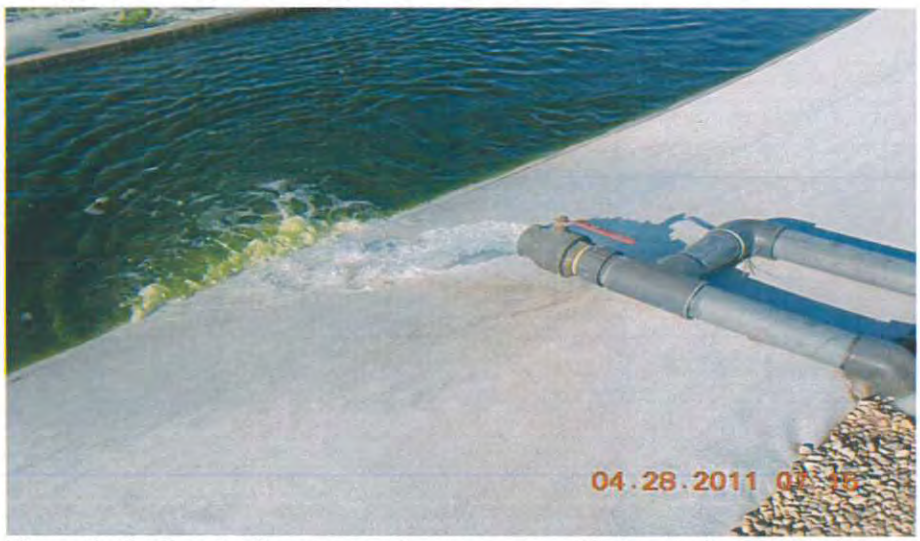

Figure 6. Fresh water from a ground water source added to attain proper salinity.

CEHMM pond water volumes are monitored and managed by way of dedicated four inch diameter, inline McPropeller® flow meters. Permanent flow meters are calibrated to manufacturers' and local water conservancy district specifications.

Ash-free dry weight (AFDW) concentrations were measured from each harvest sample. AFDW was determined using prescriptive methodology. Personnel who supervise the collection of pond samples are trained and certified in accordance with federal (e.g., EPA, DOE) and state (e.g., NM Safe Drinking Water Act) edicts which provide prescriptive, procedural sampling protocols thus ensuring objectivity and true representative sample selection. Aliquots of 500 ml were collected at predetermined time intervals from the pond. Samples were collected in triplicate and subsequently weighed in increments of 5 ml each. These were then recorded as initial sample weight (g). Each triplicate is filtered through a laboratory grade, sterile Whatman® 47 mm glass microfiber filter and placed into a VWR® 1300 series drying oven for 1 hour at 105°C. Samples were then weighed and recorded as before ash dry weight (BADW). After recording BADW, samples were placed in a Thermolyne® F4800 ashing furnace for 1 hour at 500°C. Upon removal from the furnace, samples were weighed for a final time as after ash dry weight (AADW).

Algal concentration data, measured in grams per liter, was a calculation based on AFDW and sample weights.

Productivity, expressed in grams per meter squared per unit of time, was derived directly from algal concentration (g/l). Daily lipid percentage was determined using a modified Bligh and Dyer solvent extraction method.

The circular tank, which is 10 inches deep and 93 inches wide with a holding capacity of 300 gallons, had 37.5 gallons removed each day for five days, followed by two days of rest, and a repeat of the harvest protocol the second week. A final removal of 37.5 gallons and water replacement took place after the second two-day rest period. A mix of 37.5 gallons of fresh and brine water was added to make up the harvested amount and restore to a proper level. The circular tank was fed daily during harvest. No significant change in AFDW or algae concentration was observed. Figure 7 shows the shape and size of the circular tank.

Figure 7. Circular tank.

The demonstration pond was subjected to the following over a two week period:

The first four days the following protocol was used: A grab sample was taken to assess AFDW from which algal concentration and productivity data were calculated. Freshwater was then added to restore chemical parameters and desired water level. Fifteen hundred gallons were then removed from the pond and pumped to cone bottom tanks. Flocculation agents were added to the harvest and the algae settled out over a four hour period. Subsequently the supernatant was pumped back to the source pond. The pond was fed twice a week.

The second four days a modified protocol was used: The first day a grab sample from which AFDW was determined was taken immediately and then fresh water added to restore the pond to proper chemical parameters and water level. A thirty minute interval allowed the culture to fully mix. Two additional samples were taken, one immediately after harvest and one at the end of the day. Sampling for AFDW occurred with the same pattern the remainder of the week. The first day was the only one with a fresh water adjustment before harvest. The penultimate samples for this demonstration were taken on the day after the second three day rest (May 9, 2011). Make up water consisted of the supernatant from the harvested flocculant and well water to ensure culture capacity and proper level. The pond was fed twice during the week. Concentrated algae produced from the harvest was not relevant to this demonstration and was stored for use as a feedstock for algae oil extraction.

Meteorological data were collected with a Dynamet® weather station, equipped with a 2 m station with model DNX® 1000 datalogger, automatic power up EPROM PC400® software and sensors that included a pyranometer, and devices that will measure wind speed and direction, relative humidity, a tipping bucket rain gauge, and air and soil temperature. Optional devices included a sunshine pyranometer with a heater for direct and diffuse radiation and sunshine duration. The Dynamet® weather station was hardwired to a computer on which control software is located. Hourly measurements were recorded on the datalogger and these data downloaded into an Excel spreadsheet authored by CEHMM personnel.

Discussion

Spring and summer are optimal times for outdoor algal cultures because of an increase in temperature and photoperiod in southeastern New Mexico. Weather during the demonstration included high winds (>50 mph gusts) which contributed to evaporative loss, and several nights of atypical low temperatures. This exercise was designed to demonstrate the capability and productivity of CEHMM technology as a potential paradigm for commercial scale harvest of microalgae.

Productivity has been reported as grams per liter (g/l) per unit of time or grams per meter squared (g/m^2) per unit of time. CEHMM prefers grams per liter over time because this measurement reflects change in a volume or inventory of culture while grams per meter squared over time is a two-dimensional measurement with no reference to water depth. Nevertheless, based on requests from some industry professionals, for the sake of this report, CEHMM has chosen to adapt our pond morphology to an acre-foot model with derived values in grams/meter squared.

Results

An acre-foot of culture is a foot of water in an acre surface area. The graphic example below (Figure 8) illustrates an eighth of an acre-foot (orange) within a surface area: volume ratio of 1:1.

Figure 8. The green three-dimensional rectangle is a representation of an acre-foot; the orange volume is 1/8th of the acre-foot.

In order to calculate productivity at commercial scale, it is necessary to consider the following calculations extrapolated out to one acre-foot or 325,846 gallons of culture growing at one gram per liter.

Demonstration Pond (1/8th acre)

1 g/l = .00834540 pounds per gallon
1 acre-foot = 325,846 gallons
.00834540 lb./gal * 325846 gallons = 2719.32 lb.
2719.32 pounds*.125 = 340 lb.
1 pound = 454 grams

Therefore:

340 lb. * 454 g/lb. = 154,360 grams
1 acre = 4,047 square meters

Therefore:

154360 g ÷ 4047 m^2 = 38.14 g/m^2

Tables 1 and 2 summarize productivity results for the demonstration pond and harvest control pond, respectively. These data, based on standard deviations and a 95% confidence interval, support the contention that half of CEHMM algal cultures can be harvested weekly for at least two successive weeks with no significant difference from the harvest control pond from which nothing was harvested for the two week period. The gallons of supernatant returned to the pond plus fresh water do not equal the 1,500 gallons harvested each day. This difference is a function of evaporative loss restoration to desired chemical parameters and reestablishment of initial pond water level. The grams per liter data were developed from the first grab samples in the morning (a.m.). Data validation and verification were performed on sampling protocols as part of programmatic quality assurance and quality control.

An algorithm was written to convert grams per liter data to grams per meter squared using the logic described above for both the demonstration pond and the circular tank. The charts show one standard deviation error bar for each data point.

Table 1. Demonstration Pond Harvest and Productivity Data

Date	Harvest (gal)	Added Supernatant (gal)	H_2O Replacement (gal)	a.m. g/l	g/m^2
4/25/2011	1500	1050	3600	1.0200	38.8948
4/26/2011	1500	1100	300	0.8200	31.2684
4/27/2011	1500	1250	2400	0.9067	34.5745
4/28/2011	1500	1250	1500	0.7733	29.4876
4/29/2011				0.7467	28.4733
Three day rest					
5/2/2011	1500	1200	2000	0.9133	34.8261
5/3/2011	1500	1400	800	0.8467	32.2865
5/4/2011	1500	1200	800	0.8067	30.7612
5/5/2011	1500	1200	800	0.8400	32.0310
5/6/2011				0.8000	30.5057
Three day rest					
5/9/2011				0.8744	34.3190
			Average	0.8900	32.4935
			Std. Dev.	0.9193	02.8282
			95% Confidence Level	0.0637	01.6713

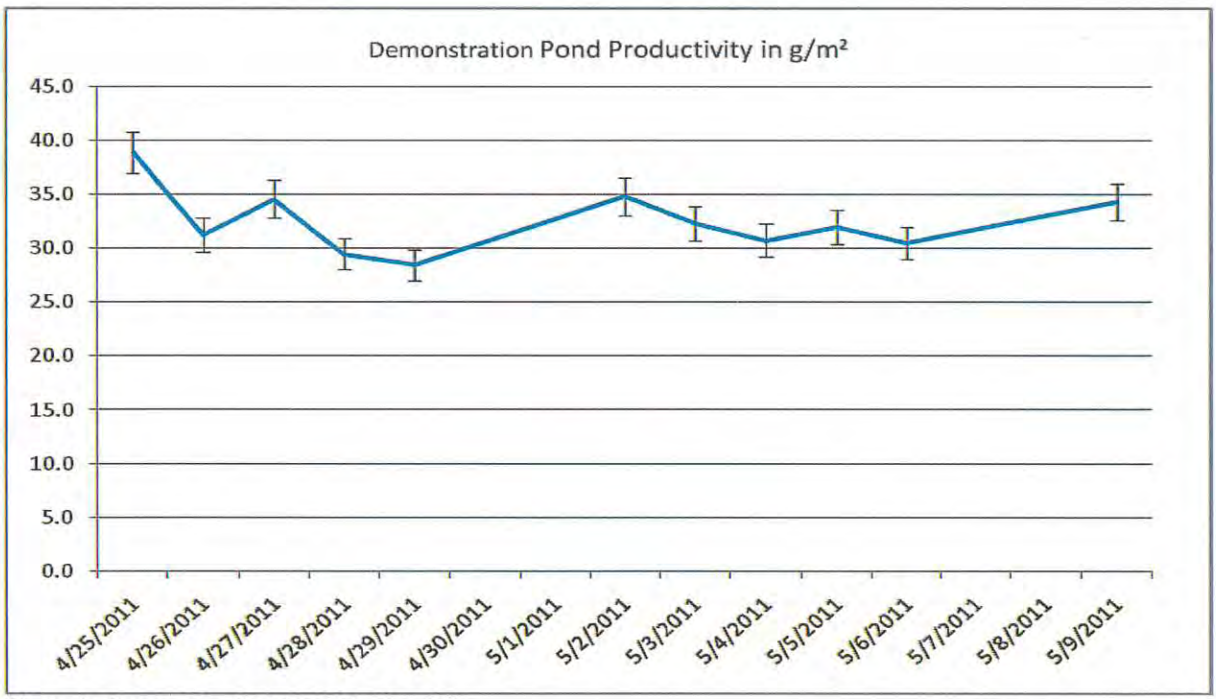

Chart 1. Demonstration Pond Productivity

An unpaired Student t-test between grams per meter squared for the Demonstration Pond and Harvest Control Pond resulted in a t value of 1.55 with a mean difference between samples of

1.99. The probability of this result, assuming the null hypothesis, is 0.138. By conventional criteria, the difference between the data sets was not statistically significant at a 95% confidence interval with nineteen degrees of freedom.

Table 2. Harvest Control Productivity

Date	a.m. grams per liter	g/m^2
4/25/2011	0.8333	31.7756
4/26/2011	0.7267	27.7107
4/27/2011	0.9133	34.8261
4/28/2011	0.8000	30.5057
Three day rest		
5/2/2011	0.6667	25.4227
5/3/2011	0.7667	29.2359
5/4/2011	0.8000	30.5057
5/5/2011	0.7933	30.2503
5/6/2011	0.8000	30.5057
Three day rest		
5/9/2011	0.9067	34.574
Average	0.8700	33.1750
Std. Dev.	0.0183	0.6997
95% Confidence Level	0.0119	0.4571

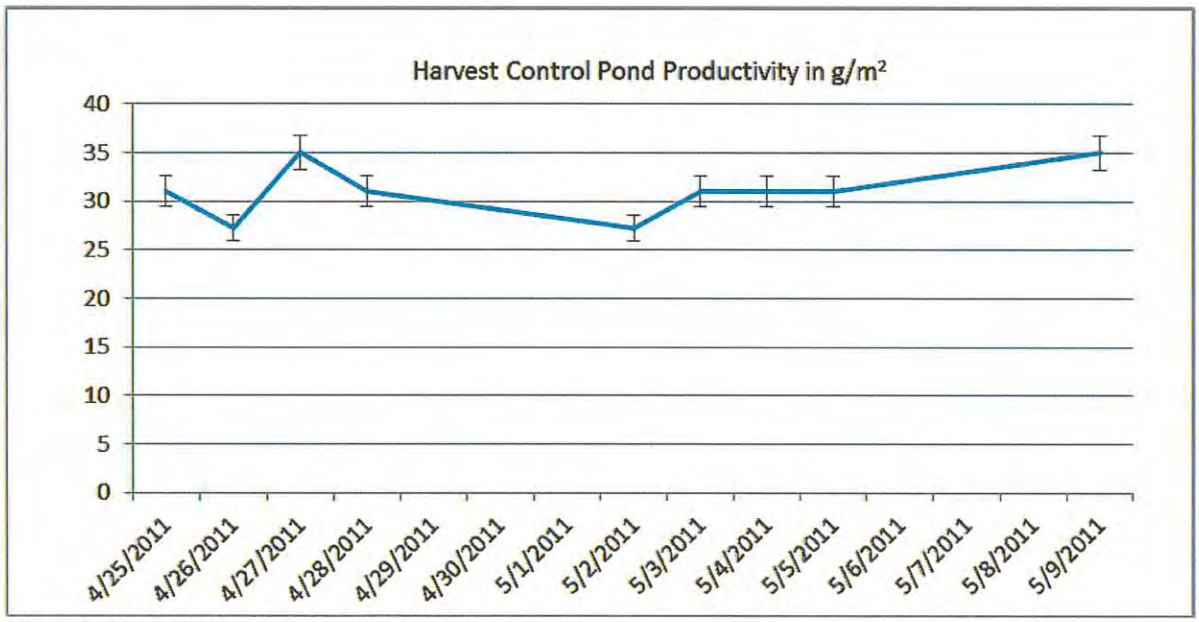

Chart 2. Harvest Control Pond Productivity

Circular Fiberglass Tank

The 8' tank had a diameter of 93 inches. The radius was 3.875 feet. The depth was 10 inches.

Therefore:

Area of the tank = $3.875^2 * \pi = 47.1730$ sq. ft. which is equivalent to 4.3825 m^2

Volume removed = 37.5 gallons

Therefore:

37.5 gal * 3.785 (metric conversion) = 141.9521 liters harvested every 24 hours.

0.8 g/l * 141.9521 liters = 113.56 grams harvested

113.55 g ÷ 4.3825 m^2 (surface area of tank) = 26.2570 g/m^2

0.7 g/l * 141.9521 liters = 99.3664 grams harvested

99.3664 g ÷ 4.3825 m^2 = 22.6735 g/m^2

To convert to an acre-foot model at a 12 inch depth, multiply g/m^2 by 1.2.

Hence,

for 0.8 g/l, 26.2570 g/m^2 * 1.2 = 31.5084 g/m^2

for 0.7 g/l, 22.6735 g/m^2 * 1.2 = 27.2082 g/m^2

Table 3. Circular Tank Harvest and Productivity

Date	Harvest (gal)	H_20 Replacement (gal)	a.m. g/l	g/m^2
4/25/2011	37.5	37.5	0.7867	30.5780
4/26/2011	37.5	37.5	0.8000	31.0950
4/27/2011	37.5	37.5	0.7800	31.5084
4/28/2011	37.5	37.5	0.7867	30.3176
4/29/2011	37.5	37.5	0.7200	27.9855
Two day rest				
5/2/2011	37.5	37.5	0.6933	26.9474
5/3/2011	37.5	37.5	0.7333	28.5024
5/4/2011	37.5	37.5	0.6867	26.6912
5/5/2011	37.5	37.5	0.6933	29.9477
5/6/2011	37.5	37.5	0.6733	26.1703
Two day rest				
5/9/2011	37.5	37.5	0.7667	29.80071
		Average Std. Dev. 95% Confidence Level	0.7382 0.0445 0.0254	28.6922 1.7514 1.0350

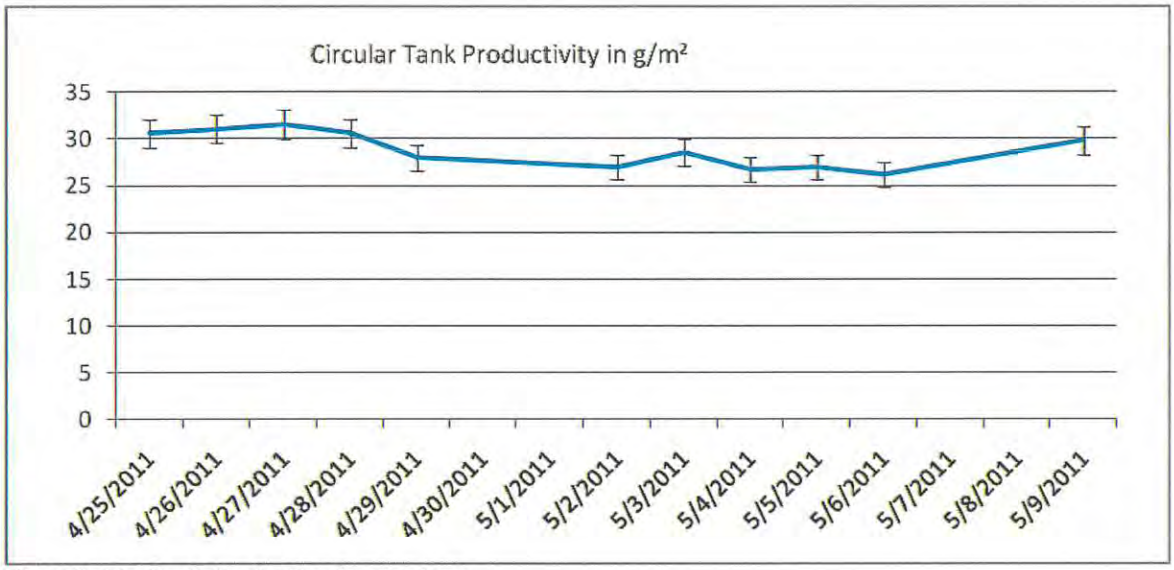

Chart 3. Productivity for the circular tank

Weather conditions during the demonstration are found in Table 4. Data were collected at 9:00 a.m. local time. High winds exacerbated evaporative loss during the demonstration period.

Table 4. Weather Data During Demonstration

Date	Air Temp (C) Avg.	Rel. Humidity (%) Avg.	Solar Rad. Avg. KW/sq. m Avg.	Wind Direction degrees	Wind Speed mph	Rain Gauge mm Total	Soil Temp (C) Avg.	Tot. Rad. W/sq. m	Diffuse Rad. W/sq. m	0 = no sun 1 = sun
4/25/11	21.38	19.21	0.628	308.4	39.57	0	20.58	670.4	324.7	1.005
4/26/11	23.59	13.05	0.643	264.8	33.68	0	20.10	684.8	252.0	1.006
4/27/11	15.75	8.97	0.664	317.8	31.96	0	17.82	721.0	260.5	1.005
4/28/11	15.66	35.25	0.638	157.4	39.21	0	17.14	672.5	246.0	1.005
4/29/11	18.69	31.22	0.545	144.2	40.00	0	18.59	588.7	199.3	1.006
4/30/11	21.85	12.44	0.549	1.725	19.73	0	19.72	590.2	212.4	1.005
5/1/11	12.65	27.44	0.462	10.48	17.28	0	18.84	460.2	412.0	0.183
5/2/11	8.78	52.10	0.605	335.9	00.02	0	14.40	640.9	315.9	1.003
5/3/11	10.99	27.61	0.568	85.8	52.30	0	13.44	586.4	208.9	1.006
5/4/11	13.47	21.44	0.596	129.2	11.06	0	14.86	617.7	244.3	1.006
5/5/11	15.84	32.80	0.667	349.5	26.73	0	17.75	689.8	266.1	1.005
5/6/11	18.35	26.27	0.468	163.8	24.05	0	18.08	523.2	233.4	1.005
5/9/11	27.37	6.45	0.331	208.3	24.58	0	21.32	543.5	273.2	1.006

Conclusions and Comments

A pond which held 12,000 gallons of algal culture was intensely harvested with half the content removed in each of two consecutive weeks. There was no significant degradation of the culture based on productivity, measured daily in either grams/liter or grams per meter squared. A test pond was also subjected to intense harvest. No significant impact on the culture was observed over the two-week period using the same evaluation criteria.

This result suggests that open raceway algal ponds can withstand high levels of seasonal harvests in southeastern New Mexico. This would imply that intense harvest rates could be applied to a large number of algal ponds in support of a commercial operation.

Results from this project graphically demonstrate that the combined elements of CEHMM crop management and crop protection provide sustainable cultures commensurate with commercial dimensions. CEHMM conclusively demonstrated that the CEHMM crop management system is capable of meeting or exceeding this performance criterion.

CEHMM maintains, however, to calculate productivity using two dimensional criteria is neither accurate nor meaningful in the conduct of operations of a commercial algal facility. The metric of grams per meter squared is an antiquated density determination with indeterminate genesis and contradicts common sense understanding of what the term productivity actually implies. In summary, current industry and academic trends calculate productivity based on the resident inventory as a "snapshot in time" rather than as a calculation for the reproductive rates of a crop required to compensate for inventory loss or as a prediction for crop production yields.

Agronomy can be defined as the science and technology of cultivating a photosynthetic organism such as plants in the production and use of food, fuel, and feed. Furthermore, agronomy is recognized as the **applied application** of disciplines such as biology, chemistry, engineering, ecology, and genetics. These definitions conclusively demonstrate that the path to commercialization in algae is strictly, by definition, FARMING. Current industry trends should be redirected to commercial viability as agricultural productivity which can be determined by either tons or bushels of product per acre. CEHMM has proven repeatedly that algal crop yields, based on tons per acre-foot of water, in addition to pond recovery can be assessed and predicted. Moreover, CEHMM has repeatedly demonstrated proficiency in the construction, maintenance, and operation of commercial scale production ponds and related infrastructure.

Challenges before the industry remain the consistency of the product quality, quantity and sustainability. CEHMM has developed, implemented, and demonstrated effective crop protection and crop management at commercial scale that provides for a consistent domesticated wild strain monoculture with predictable oil content and intrinsic values for food, fuel and feed markets.

CEHMM LEDA Application
Attachment 2.a.

CEHMM Financial Statements FY 2009 & FY 2010
FY 2011 Income Statement and Balance Sheet

CEHMM LEDA Application
Attachment 2.c.

Income Statement for Three Years for Algae Project

	2012	2013	2014
Revenues	$875,000	$875,000	$875,000
Gross Profit	**$875,000**	**$875,000**	**$875,000**
Expenses			
Salaries	$760,415	$760,415	$760,415
Direct	$50,000	$50,000	$50,000
Insurance	$12,000	$12,000	$12,000
O&M	$15,000	$15,000	$15,000
G&A	$15,000	$15,000	$15,000
Total	**$852,415**	**$852,415**	**$852,415**
Net Profit	**$22,585**	**$22,585**	**$22,585**

CEHMM LEDA Application
Attachment 3.a.

CEHMM HISTORY AND OVERVIEW

Organizations are born from ideas and people make these ideas a reality. Community leaders of Carlsbad, NM had the idea for a Center of Excellence for Hazardous Materials Management (CEHMM). The Waste Isolation Pilot Plant (WIPP) is a community success story that offers a solution for transuranic waste disposal. CEHMM was to build on this legacy of significant hazardous materials management expertise and expand scientific research into new areas that would benefit the public and environment.

CEHMM was incorporated May 7, 2004 as a State of New Mexico non-profit corporation. CEHMM was established as a not-for-profit scientific research organization and applied for and received a U.S. Internal Revenue Service 501(c)(3) tax exemption as a public charity.

CEHMM was initially funded in 2004 with a two million dollar grant from the U.S. Department of Energy, Carlsbad Field Office. CEHMM's subsequent financial support has come from federal and state grants and various donor contributions to the cooperative conservation program. CEHMM has a DOE approved financial management system and an independent audit is completed annually.

Since its inception, CEHMM has identified and pursued applied research projects that have nation-wide impact and are innovative, meaningful, and practical. CEHMM has created a wide range of cutting edge research programs, including developing technology for using algae as a feedstock for biofuels and co-products, biomonitoring for the avian influenza and West Nile viruses, and cooperative conservation of species listed as warranted but precluded on the federal endangered species list. The purpose of the CEHMM projects is to work toward practical solutions to issues that affect both human health and the environment. The projects serve the community, the region, and the state through educational outreach, job creation, and research leading to resolution of important technical and environmental challenges. CEHMM has had swift advances in these projects due to the varied talents of the CEHMM staff and directors, and the organization's success in developing strong partnerships with universities, national laboratories, government entities, and private industry.

Algae Project: In 2006, CEHMM began the algae project and remains a leader in developing practical, economically feasible systems for growing and harvesting algal cultures, crop protection, and extracting oil from these cultures. This technology is now nationally regarded as one of the most promising sources of renewable transportation fuel.

Education Project: The ongoing educational project encompasses various activities designed to disseminate information to the general public and to the public schools about hazardous materials management and CEHMM projects. CEHMM personnel conduct tours of the algae facilities for student groups and other interested parties. They visit the public schools and deliver information at conferences and public forums on renewable energy research and hazardous materials management. CEHMM regularly contributes to books, other publications,

and films about renewable energy. CEHMM completed an alternative energy curriculum that will help to develop student awareness toward applied research and stimulate interest that will motivate students to pursue careers in alternative energy. Disciplines such as this will be critical in the development of a future workforce for the emergence of this national agenda for alternative energy.

Conservation Project: CEHMM has long-standing partnerships with the BLM and USFWS on a variety of conservation efforts. Collaborations have enabled CEHMM to perform work in the areas of wildlife water replacement, archaeological mitigation in southeast NM to include excavation and data collection, dunes sagebrush lizard surveys and habitat improvement, and lesser prairie-chicken surveys and habitat improvement. For several years, CEHMM, BLM, and USFWS worked together to develop a Candidate Conservation Agreement to set up a mechanism to conserve lesser prairie-chicken and dunes sagebrush lizard habitats while the species are still in candidate status. Landmark legal agreements were signed by federal and state authorities on December 8, 2008. These agreements are providing demonstrable results in support of this undertaking. These programs rely on donor contributions for continued success.

Biomonitoring Project: From 2007 through 2009, CEHMM conducted a three-year avian biomonitoring project directed toward detecting the H5N1(avian flu) virus, the West Nile virus, banned pesticides and heavy metals. The project monitored a scavenger species, the Chihuahuan Raven, in areas of west Texas, southern New Mexico, and the adjacent U.S.-Mexico border areas. The arrival of the H5N1 virus in the United States is a matter of national security and is of nationwide importance. Early detection is key to deterring the spread of the virus and protecting human health from possible communicable mutations of the virus. The project established baseline information in the target area and obtained statistical power to detect trends and to characterize distribution and effects of heavy metals, toxins, and viruses.

CEHMM LEDA Application
Attachment 3.d.1

Final reports of CEHMM projects/grants completed:

1) DOE grant DE-FG29-04SR20282, Establish and operate the Center of Excellence for Hazardous Materials at the WIPP Site in Carlsbad, NM which will focus its activities on reducing waste streams that threaten public health along the U.S.-Mexico border

2) DOE grant DE-FG30-05EW03004, Develop Programs to Improve Protection of Worker Safety, Human Health, and the Environment

3) DOE grant DE-SC0000581, CEHMM Alternative Energy Research and Education

4) DOE grant DE-SC0005319, Center of Excellence for Hazardous Materials Management (CEHMM) Algae to Biodiesel Project

5) F&W grant 20181RJ004, Habitat Improvement Projects on Private Lands to Benefit the Lesser Prairie-Chicken in Southeastern New Mexico

6) New Mexico Supplemental Environmental Project (SEP) on algae project

Center of Excellence for Hazardous Materials Management

FINANCIAL STATEMENTS
with
INDEPENDENT AUDITORS REPORT
CERTIFIED PUBLIC ACCOUNTANT

Year Ended September 30, 2011

ROBERT J. PASLAY
Certified Public Accountant

TABLE OF CONTENTS

ROBERT J. PASLAY
Certified Public Accountant

INDEPENDENT AUDITORS' REPORT

To the Board of Directors
Center of Excellence for Hazardous Materials Management
Carlsbad, NM

We have audited the accompanying statement of financial position of the Center of Excellence for Hazardous Materials Management (CEHMM) (a nonprofit organization) as of September 30, 2011, and the related statements of activities and cash flows for the year then ended. These financial statements are the responsibility of the CEHMM management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and the significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of CEHMM as of September 30, 2011, and the changes in its net assets and its cash flows for the year then ended in conformity with accounting principles generally accepted in the United States of America.

In accordance with *Government Auditing Standards*, we have also issued our report dated January 30, 2012 on our consideration of CEHMM management's internal control over financial reporting and on our tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements and other matters. The purpose of that report is to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing and not to provide an opinion on internal control over financial reporting or on compliance. That report is an integral part of an audit performed in accordance with *Government Auditing Standards* and should be considered in assessing the results of our audit.

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Our audit was conducted for the purpose of forming an opinion on the basic financial statements of CEHMM taken as a whole. The accompanying Schedule of Expenditures of Federal Awards is present for purposes of additional analysis, as required by the U. S. Office of Management and Budget Circular A-133, Audits of States, Local Governments, and Non-Profit Organizations, and is not a required part of the financial statements. Such information has been subjected to the auditing procedures applied in the audit of the basic financial statements and, in our opinion, is fairly stated in all material respects in relation to the basic financial statements taken as a whole.

February 7, 2012

Center of Excellence for Hazardous Materials Management
Statement of Financial Position
September 30, 2011

ASSETS		2011
Current assets		
Cash and cash equivalents	$	2,117,952.
Grant receivable		20,000.
Prepaid expenses and other current assets		38,919.
Total current assets	$	2,176,871.
Property and equipment net (Note B)		851,532.
Total assets	$	3,028,403.
LIABILITIES AND NET ASSETS		
Current liabilities		
Accounts payable	$	122,815.
Accrued liabilities		95,195.
Total current liabilities	$	218,010.
Net assets		
Unrestricted		827,103.
Temporarily restricted (Note C)		1,983,290.
Total net assets	$	2,810,393.
Total liabilities and net assets	$	3,028,403.

The accompanying notes are an integral part of these financial statements.

Center of Excellence for Hazardous Materials Management
Statement of Activities
September 30, 2011

		2011
Unrestricted net assets		
Unrestricted revenues and gains		
Grant revenue	$	764,391.
In-Kind revenue		48,000.
Consulting income		2,336.
Administrative income		14,949.
Interest income		4,088.
Other income		7,624.
Total unrestricted revenues and gains	$	841,388.
Net assets released from restrictions		
Restricted satisfied by payments	$	1,807,782.
Total unrestricted revenues, gains and other support	$	2,649,170.
Expenses		
Salaries	$	1,069,815.
Consulting		597,294.
Benefits		368,544.
Supplies		118,969.
Lease/Rental		83,268.
Depreciation		146,882.
Payroll taxes		88,601.
Information technologies		3,898.
Professional services		38,420.
Insurance		29,373.
Repairs and maintenance		33,273.
Conferences and meetings		4,900.
Other operating and maintenance		10,453.
Occupancy		57,459.
Travel		23,507.
Total expenses	$	2,674,656.
Decrease in unrestricted net assets	$	(25,486.)
Temporarily restricted net assets		
Contributions	$	1,663,713.
Net assets released from restrictions		
Restrictions satisfied by payments	$	(1,807,782.)
Increase in temporarily restricted net assets	$	(144,069.)
Decrease in net assets	$	(169,555.)
Net assets at beginning of period		2,979,948.
Net assets at end of period	$	2,810,393.

The accompanying notes are an integral part of these financial statements.

Center of Excellence for Hazardous Materials Management
Statement of Cash Flows
September 30, 2011

		2011
Cash flows from operating activities:		
Decrease in net assets	$	(169,555.)
Adjustments to reconcile increase in net assets to net cash provided by operating activities:		
Depreciation		147,312.
Grant/account receivable		(19,500.)
Prepaid expenses		4,439.
Unbilled revenue		476.
Accounts payable		23,691.
Accrued liabilities		(16,157.)
Net cash provided by operating activities	$	(29,294.)
Cash flows from investing activities:		
Fixed assets	$	(66,240.)
Net cash used in investing	$	(66,240.)
Cash flows from financing activities:		----
Net decrease in cash	$	(95,534.)
Cash at beginning of period	$	2,213,486.
Cash at end of period	$	2,117,952.

The accompanying notes are an integral part of these financial statements.

NOTES TO THE FINANCIAL STATEMENTS

NOTE A Summary of Significant Accounting Policies

This summary of significant accounting policies of the Center of Excellence for Hazardous Materials (CEHMM) (Organization) is presented to assist in the understanding of the Organization's financial statements. The financial statements and notes are the representation of the Organization's management who is responsible for their integrity and objectivity. The financial statements of the Organization have been prepared in conformity with generally accepted accounting principles (GAAP) by the United States of America as applied to non-profit entities. The Financial Accounting Standards Board (FASB) is the accepted standard-setting body for establishing accounting and financial reporting principles. The more significant of the Organization's accounting principles are described below.

1. *Nature of Business*

   The CEHMM is dedicated to applied research in areas of study that benefit the environment, help create jobs in clean, new industries, and preserve human health. The Organization has a nationally recognized research and development project in growing, harvesting, and extracting oil from algae with the goal of producing transportation fuel and using the algae biomass for co-products. A wildlife conservation project focused on the preservation of two threatened species, the lesser prairie chicken and the dunes sagebrush lizard, is also part of the Organization's portfolio of projects. This conversation project has been recognized by the federal government, the State of New Mexico, and industry as an innovative model for the preservation of species.

2. *Basis of Accounting*

   The financial statements of CEHMM have been prepared on the accrual basis of accounting, and accordingly reflect all significant receivables, prepaids, payables, accruals, and other liabilities.

3. *Basis of Presentation*

   Financial statement presentation follows the recommendations of the FASB Accounting Standards Codification (ASC) 958, *Not-for-Profit Entities*. Under FASB ASC 958, the Organization is required to report information regarding its financial position and activities according to three classes of net assets: unrestricted net assets, temporarily restricted net assets, and permanently restricted net assets.

4. *Assets, Liabilities and Net Assets*

Cash and cash equivalents: Cash and cash equivalents consist of cash held in checking, savings, and money market accounts in one bank in Carlsbad, New Mexico. Amounts on deposit are insured by the Federal Deposit Insurance Corporation up to $250,000.00.

Grant receivable: Grant receivable represents reimbursement amounts received from the Department of Energy subsequent to year-end for expenditures applicable to the period prior to year-end. The Organization considers the receivables to be fully collectable, thus no allowance for uncollectable amounts is considered.

Prepaid expense: Prepaid expenses include insurance premiums paid or incurred prior to year-end for the following year, rent and services.

Unbilled revenue: Unbilled revenue is revenue earned under grants received from the Department of Interior that has not yet been billed.

Property and Equipment: The Organization capitalizes all expenditures for property and equipment in excess of $500.00. Purchased property and equipment are carried at cost. Depreciation is computed using the straight-line method. The estimated useful lives of the assets range from three (3) to 15 years.

Net Assets: Contributions received are recorded as increases in unrestricted, temporarily restricted, or permanently restricted net assets, depending on the existence and/or nature of any donor restrictions.

Income Taxes: The Organization is a Not-for-Profit organization that is exempt from income taxes under Section 501(c)(3) of the Internal Revenue Code.

5. *Estimates*

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect certain reported amounts and disclosures. Accordingly, actual results could differ from the estimates. A significant estimate utilized in the preparation of these financial statements was the estimated lives of depreciable assets.

6. *Description of Program and Supporting Services*

Research and Development – Alternative Fuel Studies: The biodiesel project is a research and development project investigating production processes and the propagation, harvesting, and extraction of oil from both brine and fresh water algae. The business of biodiesel production and the impact of the future use of algae oil as a feedstock are being researched. Use of algae as a biodiesel feedstock has great potential to make biodiesel a viable replacement for significant quantities of petro diesel, thereby reducing American dependence on foreign oil. Since southeastern New Mexico has been identified as an ideal area for algae propagation, discoveries related to processes for harvesting and extraction of oil from algae has the potential to create a strong new industry for the region.

Education: The education project encompasses various activities designed to disseminate information to the general public and to the public schools about hazardous materials management and the Organization's projects. The Organization's personnel conduct tours of the biodiesel and algae facilities for student groups and other interested parties. They visit the public schools and deliver information at conferences and public forums on renewable energy research, biomonitoring, and hazardous materials management. The Organization regularly contributes to books, other publications and films about renewable energy. In addition, the Organization has developed a written curriculum in alternative energy and renewable biofuels and a second on conservation and is working to provide these curricula to the public schools.

Biomonitoring: The biomonitoring project is directed toward detecting the H5N1 virus, the West Nile virus, banned pesticides and heavy metals. The project has monitored a scavenger species, the Chihuahuan Raven, in areas of west Texas, southern New Mexico, and the adjacent U.S.-Mexico border areas. The arrival of the H5N1 virus in the Untied States is a matter of national security and is of nationwide importance. Early detection is key to deterring the spread of the virus and protecting human health from possible communicable mutations of the virus.

Conservation: The candidate conservation project proposes to develop solutions for issues related to the Endangered Species Act (ESA) and its potential effect on environmental uses of land. Stakeholders from commercial, regulatory, and special interests organizations have met to develop a southeast New Mexico regional conservation plan concerning listed wildlife, namely the lesser prairie chicken and the dunes sagebrush lizard. The Organization works with stakeholders for the purpose of improving native short-grass sand

scrub, sand dunes, and desert grassland habitats of southeastern New Mexico by fostering cooperative partnerships that meet the land stewardship goals of private landowners as well as the goal of conserving diminishing species and habitats.

7. *Fair Value of Financial Instruments*

The Organization's significant financial instruments are cash and other short-term assets and liabilities. For the financial instruments, carrying value approximates fair value.

NOTE B Property and Equipment

Property and equipment consist of the following:

	2011
Nondepreciable:	
Work in process	$ 25,820.
Depreciable:	
Furniture and fixtures	591,673.
Leasehold improvements	546,820.
Buildings	21,585.
Vehicles	144,030.
Total property and equipment	$ 1,304,108
Less: Accumulated depreciation	(452,576.)
Net property and equipment	$ 851,532.

Depreciation expense was $ 146,882.00 for the year ended September 30, 2011.

NOTE C Temporarily Restricted Net Assets

Temporarily restricted net assets are available to facilitate the Bureau of Land Management's (BLM) land management in accordance with the memorandum of agreement as well as the Candidate Conservation Agreement (CCA) between the Organization and the BLM. In addition, Supplemental Environmental Project payments are restricted for the Algae to Biofuels Project.

NOTE D Concentration of Grants

Approximately 96% of the Organization's grant funding for the year ending September 30, 2011 was received from the U.S. Department of Energy, while the remaining 4% was received from the Department of Interior.

Approximately 30% of the Organization's total revenue comes from the U.S. Department of Energy with the remaining 70% from Supplemental Environmental Project payments and other contributions with a small portion in consulting income.

It is reasonably possible that revenue from the above disclosed sources may be lost in the future term as a result of reduction in funding from the U.S. Department of Energy, and the cessation of Supplemental Environmental Project payments contributions. Private industry continues to support the mission of CEHMM and has committed to a three year contribution program to support the program.

NOTE E Commitments

The Organization leases two buildings and a copy machine on long-term operating leases. The Organization is on an auto renewal on March 1 of each year for its office lease at 505 North Main Street in Carlsbad. On October 20, 2010, the Organization renewed its lease for the property located at 67 East Four Dinkus Road in Artesia, New Mexico for ten additional years ending November 30, 2020. Rental expenses were $33,200.00 and $30,000.00, respectively for the years ending September 30, 2011.

NOTE F Defined Contribution Plan

On June 17, 2005 the Organization initiated a defined contribution pension plan (Plan) covering all employees who have attained the age of 18 and after 90 days of service. Participants may elect to make salary deferral contributions to the Plan up to the amount as limited by Federal law and the Organization will match that contribution up to 5% of the participant's eligible compensation. The Organization can terminate the Plan at any time. The amount contributed to the Plan by the Organization was $48,291.53 for the year ending September 30, 2011. This amount is included in benefit expenses.

NOTE G Functional Classification of Expenses

Expenses by function were as follows:

	2011
Expenses	
Program services	
Research, development, and testing	$ 906,501.
Center management	474,532.
Cooperative conservation	93,663.
CCA/CCAA	502,088.
Supporting services	
Administrative and general	697,872.
Total Expenses	$ 2,674,656.

NOTE H Date of Management Review

The Organization has evaluated subsequent events through January 30, 2012, the date which the financial statements were available to be issued.

COMPLIANCE SECTION

ROBERT J. PASLAY
Certified Public Accountant

Report on Internal Control Over Financial Reporting and on Compliance and Other Matters Based on an Audit of Financial Statements Performed in Accordance With *Government Auditing Standards*

To the Board of Directors
Center of Excellence for Hazardous Materials Management
Carlsbad, NM

We have audited the financial statements of the Center of Excellence for Hazardous Materials Management (CEHMM) as of and for the year ended September 30, 2011, and have issued our report thereon dated February 7, 2012. We conducted our audit in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States.

Internal Control Over Financial Reporting

In planning and performing our audit, we considered the CEHMMs internal control over the financial reporting as a basis for designing our auditing procedures for the purpose of expressing our opinion on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of the CEHMMs internal control over financial reporting. Accordingly, we do not express an opinion of the effectiveness of the Organization's internal control over financial reporting.

A *deficiency* in internal control exists when the design or operation of a control does not allow management or employees in the normal course of performing their assigned functions; to prevent, or detect and correct misstatement on a timely basis. A *material weakness* is a deficiency or a combination of deficiencies in internal control such that there is a reasonable possibility that a material misstatement of the entity's financial statements will not be prevented, or detected and corrected on a timely basis.

Our consideration of internal control over the financial reporting was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control over financial reporting that might be deficiencies, or material weaknesses. We did not identify any deficiencies in internal control over financial reporting that we considered to be material weaknesses, as identified above.

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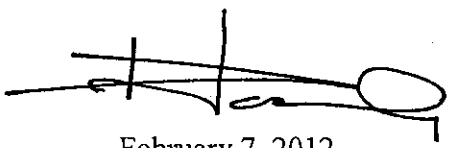
Compliance and Other Matters

As part of obtaining reasonable assurance about whether the CEHMMs financial statements are free of material misstatement, we performed tests of its compliance with certain provisions of laws, regulations, contracts and grant agreements, noncompliance with which could have a direct and material effect on the determination of financial statement amounts. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests disclosed no instances of noncompliance or other matters that are required to be reported under *Government Auditing Standards*.

This report is intended for the information and use of management, the Board of Directors, others within the entity, Federal awarding agencies, and pass-through entities and is not intended to be and should not be used by anyone other than these specified parties.



February 7, 2012

FEDERAL FINANCIAL ASSISTANCE

ROBERT J. PASLAY
Certified Public Accountant

Report on Compliance With Requirements Applicable To Each Major Program and on Internal Control Over Compliance in Accordance With OMB Circular A-133

To the Board of Directors
Center of Excellence for Hazardous Materials Management
Carlsbad, NM

Compliance

We have audited the compliance of the Center of Excellence for Hazardous Materials Management (CEHMM) with the types of compliance requirements described in the U.S. Office of Management and Budget (OMB) *Circular A-133 Compliance Supplement*, which could have a direct and material effect on each of the CEHMMs major federal programs for the year ended September 30, 2011. The CEHMMs major federal programs are identified in the summary of auditor's results section of the accompanying schedule of findings and questioned costs. Compliance with the requirements of laws, regulations, contracts, and grants applicable to each of its major federal programs is the responsibility of the CEHMMs management. Our responsibility is to express an opinion on the CEHMM compliance based on our audit.

We conducted our audit of compliance in accordance with auditing standards generally accepted in the United States of America; the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States; and OMB Circular A-133, *Audits of States, Local Governments, and Non-Profit Organizations*. Those standards and OMB Circular A-133 require that we plan and perform the audit to obtain reasonable assurance about whether noncompliance with the types of compliance requirements referred to above that could have a direct and material effect on a major federal program occurred. An audit includes examining, on a test basis, evidence about the CEHMM compliance with those requirements and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion. Our audit does not provide a legal determination of CEHMM compliance with those requirements.

In our opinion, the CEHMM complied, in all material respects, with the compliance requirements referred to above that could have a direct and material effect on each of its major federal programs for the year ended September 30, 2011.

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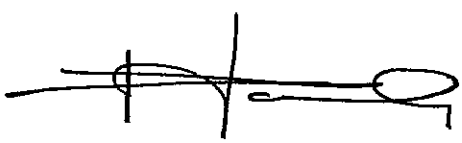
Internal Control Over Compliance

The management of CEHMM is responsible for establishing and maintaining effective internal control over compliance with the requirements of laws, regulations, contracts, and grants applicable to federal programs. In planning and performing our audit, we considered the CEHMMs internal control over compliance with the requirements that could have a direct and material effect on a major federal program to determine the auditing procedures for the purpose of expressing our opinion on compliance and to test and report on internal control over compliance in accordance with OMB Circular A-133, but not for the purpose of expressing an opinion on the effectiveness of internal control. Accordingly, we do not express an opinion on the effectiveness of the CEHMM internal control over compliance.

A *deficiency* in internal control over compliance exists when the design or operation of a control over compliance does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, noncompliance with a type of compliance requirement of a federal program on a timely basis. A *material weakness* in internal control over compliance is a deficiency, or combination of deficiencies, in internal control over compliance, such that there is a reasonable possibility that material noncompliance with a type of compliance requirement of a federal program will not be prevented, or detected and corrected, on a timely basis.

Our consideration of internal control over compliance was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control over compliance that might be deficiencies, significant deficiencies, or material weaknesses. We did not identify any deficiencies in internal control over compliance that we consider to be material weaknesses, as defined above.

This report is intended for the information and use of management, the Board of Directors, others within the entity, Federal awarding agencies, and pass-through entities and is not intended to be and should not be used by anyone other than these specified parties.



February 7, 2012

Center of Excellence for Hazardous Materials Management
Schedule of Expenditures of Federal Awards
For the year ended September 30, 2011

Grant Title	Grant Number	Federal CFDA Number	Program or Award Amount	Expenditures
U.S. Department of Energy				
Alternative energy, research and education	DE-SC0000581	81.049	$729,000.00	$729,000.00 (1)
U.S. Department of Interior				
Lesser Prairie Chicken Habitat Restoration "ARRA"	1448-20181-09-R-J004	15.656	117,000.00	35,391.00
		Total	$846,000.00	$764,391.00

(1) Denotes Major Federal Financial Assistance Program.

Note: This schedule is presented on the program's basis of accounting. The information in this schedule is presented in accordance with OMB Circular A-133, *Audits of States, Local Governments, and Non-Profit Organizations.*

The accompanying notes are an integral part of these financial statements.

Center of Excellence for Hazardous Materials Management
Schedule of Findings and Questioned Costs
For the year ended September 30, 2011

PROGRAM	DESCRIPTION
Type of Report on Financial Statements	Unqualified Opinion
Significant Deficiencies	None
Material Weaknesses Involving Significant Deficiencies	None
Noncompliance Material to the Financial Statements	None
Type of Report on Compliance with Major Programs	Unqualified Opinion
Findings and Questioned Costs for Federal Awards	None
Dollar Threshold Considered Between Type A and Type B Programs	$300,000.00
Low Risk Auditee Statements	The Organization was Classified as a low-risk Auditee in the context of OMB A-133
Major Federal Program	U.S. Department of Energy Grants DE-SC0000581
Pass-through Entity	None

Center of Excellence for Hazardous Materials Management
Schedule of Status of Prior Year Finding(s)
For the year ended September 30, 2011

SCHEDULE REFERENCE NUMBER: 10-XX

There were no findings identified in the 2010 audit report.