COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
WESTERN REGIONAL OFFICE

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Governor

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TRUDY COXE
Secretary

DAVID B. STRUHS
Commissioner

OCT 28 1996

Mr. Michael A. Kulig, Plant Manager
Monsanto Company
Indian Orchard Plant
730 Worcester Street
Springfield, Massachusetts 01151

Re: PVAPCD—Springfield
Regulation 310 CMR 7.19
Application # 1-E-94-106
Transmittal # 88098
NOx RACT Emission Control Plan
Revision 2

FINAL APPROVAL

Mr. Kulig:

The Department of Environmental Protection, Bureau of Waste Prevention, Western Regional Office ("Department"), has completed its review of your ***Emission Control Plan—Revision 2*** ("ECP") for the proposed implementation of Reasonably Available Control Technology ("RACT") for oxides of nitrogen ("NOx") generated at Monsanto Company, Indian Orchard Plant ("Monsanto") located on Worcester Street in Springfield, Massachusetts.

Monsanto is a major source of emissions of NOx, with potential emissions of ≥50 tons per year ("tpy"). As a major source, Monsanto was required to submit an ECP in accordance with *Regulation 310 CMR 7.19(3) Emission Control Plans*. Three of the boilers at the facility are subject to *Regulation 310 CMR 7.19(4) Large Boilers*, *7.19(6) Small Boilers*, and *7.19(12) Miscellaneous RACT* as contained in 310 CMR 7.00 "Air Pollution Control Regulations" adopted by the Department pursuant to the authority granted by Massachusetts General Laws, Chapter 111, Section 142 A-E, Sections 4 and 6.

The NOx RACT ECP application was submitted and signed by Michael A. Kulig, Plant Manager, Monsanto Company, Springfield, Massachusetts.

Monsanto originally submitted their ECP on April 1, 1994. A first public hearing on the Draft ECP approval was held on Friday, June 16, 1995 at 10:00 AM in Room

413A at the Western Regional Office of the Massachusetts Department of Environmental Protection in Springfield, Massachusetts. No comments were received at this hearing. Written comments were received from the United States Environmental Protection Agency, Region 1 ("USEPA") dated June 9, 1995. The Department's responses to the USEPA comments are detailed in **APPENDIX A** of this **FINAL APPROVAL**.

After the public hearing, the Department issued a Statement of Technical Deficiency to Monsanto dated November 6, 1995 stating that, since Monsanto did not want a restriction on the Boiler #11 operation, they should recalculate the cost of add-on NOx controls for Boiler #11 reflecting 100% utilization. (Monsanto had calculated the cost of NOx control based on 50% utilization in the first ECP submittal). Monsanto was also to propose at this time adjusted cost figures incorporating the increased costs of maintenance associated with SNCR control technology.

Monsanto's responded by submitting ***Emission Control Plan—Revision 2*** on February 22, 1996 with revised cost calculations for NOx control based on increased maintenance (three additional one-week outages per year), increased fuel costs (natural gas cost in Boilers #9 & #10 replacing the coal cost in Boiler #11) and lost revenue from the #11 Boiler's electical production. Monsanto did not calculate these costs based on 100% boiler availability.

The Department has recalculated Monsanto's costs based on 100% boiler availability, increased fuel costs (allowing for the use of cheaper #2 oil in Boilers #9 & #10), and lost revenue estimated costs. Based on the Department's revisions to Monsanto's cost figures, the cost of control of NOx from Boiler #11 ranges from $3700 to $5700 per ton of NOx removed.

A second public hearing on the draft ***Emission Control Plan—Revision 2*** approval was held on Friday, October 4, 1996 at 10:00 AM in Room 413A at the Western Regional Office of the Massachusetts Department of Environmental Protection in Springfield, Massachusetts. No comments were received at this hearing. Written comments were received from the Monsanto Company dated October 3, 1996. The Department's responses to Monsanto Company's comments are detailed in **APPENDIX A-2** of this **FINAL APPROVAL**.

I. APPLICABLE REGULATIONS

Boilers #9 and #10 — These boilers are subject to *Regulation 310 CMR 7.19(4) Large Boilers*. This regulation requires (in part) that any person owning, leasing, operating, or controlling a boiler having an energy input capacity of ≥100 million Btu per hour (MMBtu/hr) and <250 MMBtu/hr shall comply with the applicable

NOx emission standard specified in this Regulation, and shall perform yearly stack tests to verify continuing compliance.

Boiler #6 (H_2 off-gas boiler) — This boiler is subject to *Regulation 310 CMR 7.19(6) Small Boilers*. This regulation requires (in part) that any person owning, leasing, operating, or controlling a boiler having an energy input capacity of <50 MMBtu/hr and ≥ 20 MMBtu/hr shall tune the boiler annually according to the procedures written in the Regulation.

This boiler was permanently shutdown in December 1994 and dismantled during calendar year 1995.

Boiler #11 (coal boiler) — This boiler is subject to *Regulation 310 CMR 7.19(12) Miscellaneous RACT*. This regulation requires any person owning, leasing, operating, or controlling an emission unit with potential emissions of NOx ≥ 25 tpy, and not subject to any other emission unit category specified in 310 CMR 7.19, to submit an emission control plan as required by 310 CMR 7.19(3) to demonstrate how compliance will be achieved. The ECP approval issued by the Department under 310 CMR 7.19(3) must be approved by the EPA as a revision of the Massachusetts State Implementation Plan ("SIP").

Additionally, *Regulation 310 CMR 7.19(3) Emission Control Plans* requires (in part) that any person subject to 7.19(4) or 7.19(12) submit an emission control plan by June 1, 1994 for Department approval prior to implementation of RACT. Where the information submitted in the ECP is sufficient to support the NOx and CO emission limits and the proposed schedule, the Department will publish a notice of public hearing in accordance with M.G.L. c. 30A. The Department shall allow for a 30 day public comment period following the published notice. After the public hearing and the close of the public comment period, the Department will issue a final approval (subject to EPA acceptance and publication in the Federal Register as a SIP revision) or disapproval of the ECP.

II. Regulated Emission Units

Appendix B—Table I provides an overview of the NOx emission sources at Monsanto, the applicable regulatory requirements, and the NOx and CO emission rates. **Appendix B—Table II** provides an overview of the NOx emission sources at Monsanto that are exempt from the NOx RACT Regulations.

III. Current Boiler Operations

Boilers #9 and #10 — The historical actual NOx emissions from Boilers #9 and #10 for years 1990-1995 are summarized in **Appendix B—Table III**. Actual NOx emis-

sions from either boiler have never exceeded 33 tons per year during that time period. Boilers #9 and #10 have burned natural gas exclusively for the last several years, but are currently registered by Monsanto as capable of burning either natural gas or distillate oil.

Monsanto conducted preliminary baseline stack tests on Boilers #9 and #10 during October 1993 at reduced loads (ranging from 45% to 97%) while burning natural gas and has measured maximum NOx emission rates of less than 0.14 lb NOx/MMBtu.

Monsanto also enlisted the services of Coen, who supplies the burners for these boilers, to predict NOx emissions based on Coen's models. The modeled emissions for the #9 boiler at 100% load burning NG and oil are 0.17 lb/MMBtu and 0.20 lb/MMBtu respectively. For the #10 boiler, the modeled emssions are 0.22 lb/MMBtu and 0.25 lb/MMBtu for NG and oil respectively. These stack test results and the modeled (predicted) results are well below the applicable regulatory limits of 0.30 and 0.40 lb NOx/MMBtu for the #9 and #10 boilers respectively.

Compliance stack testing was conducted on November 3, 1995 for Boiler #9 and on December 14, 1995 for Boiler #10, both while burning NG. The NOx emission rate averaged 0.10 lb/MMBtu amd 0.12 lb/MMBtu for each respectively. Monsanto has been informed that if they wish to burn oil in either boiler, they need to obtain written Department approval beforehand, and they must compliance test withing 60 days of startup.

Boiler #6 — Monsanto conducted baseline stack tests on Boiler #6 (although this boiler is not required to meet an emission limit) while burning a hydrogen rich off-gas from their formaldehyde process. Test results indicate this boiler has a NOx emission rate of 0.0023 lb/MMBtu. Based on this emission factor, actual NOx emissions from this boiler since 1990 have never exceeded 5 tons/year. In December 1994, this boiler was permanently shutdown.

Boiler #11 (coal boiler) — The historical actual NOx emissions from Boiler #11 for years 1990-1996 (1996 emissions extrapolated to 12 month operation) are summarized in **APPENDIX B—TABLE IV**. Emissions of NOx have been 233 and 238 tpy for 1994 and 1995 respectively.

Monsanto conducted baseline stack tests on Boiler #11 during September 1993. **APPENDIX B—TABLE V** summarizes the results, and indicates a maximum NOx emission rate of 0.488 lb/MMbtu at the specified test conditions.

Monsanto also conducted stack tests to investigate how to minimize NOx emissions by optimizing combustion parameters. Monsanto is constrained in how much they can lower oxygen levels (which also lowers NOx emissions) by Department and EPA permit conditions (in accordance with the EPA BIF regulations) which require tight control of CO emissions while co-firing a methanol-rich distillate ("MRD"). A continuous emission monitor and data logging system are used to monitor compliance with these CO standards.

The first two days of testing consisted of varying the underfire air, overfire air ("OFA"), the OFA balance, and the OFA dampers while continuously monitoring NOx emission levels. The third day consisted of running the boiler at the highest possible output at the settings that were found to be optimum. **APPENDIX B—TABLE VI** summarizes the results at the optimum condition and at maximum output. The results indicate an average NOx emission rate of 0.432 lb/MMBtu at the specified test conditions.

These test results indicate that small improvements in NOx emissions can be made by optimally tuning the boiler. Based on this study, Monsanto will operate the boiler on automatic control, utilizing OFA, at an oxygen control setpoint bias of 0.36 ± 0.05 and with (nominal) boiler control settings of -7 on the FD fans bias, +20 on the OFA fans bias, and setting the OFA dampers to add more OFA to the front of the firebox. The first three control items will be incorporated as an enforceable condition of this approval and as a surrogate indicator of compliant operation.

APPENDIX B—TABLE VII summarizes the results at the first set of annual compliance tests. The results indicate an average NOx emission rate of 0.439 lb/MMBtu at the specified test conditions.

IV. RACT OPTIONS EVALUATION

Boilers #9 and #10 — These boilers will require no modifications to meet the NOx RACT Regulations.

Boiler #6 — This boiler will meet the regulatory requirement through an annual tuneup procedure, as specified in the "Regulations". In December 1994, this boiler was permanently shutdown.

Boiler #11 (coal boiler) — Monsanto is proposing the existing NOx emission limit of Boiler #11 as RACT, while incorporating the previously specified boiler control settings into the standard operating procedure for the boiler.

Monsanto's Boiler #11 currently uses OFA to minimize NOx, CO, and particulate emissions. Additionally Boiler #11 operates under Department and USEPA constraints regulating CO emissions while burning MRD (methanol-rich distillate)[1]. Using low excess air techniques to further reduce NOx emissions is difficult while burning MRD because of these restrictions on CO emissions.

Additionally, Monsanto evaluated the technical feasibility of add-on NOx controls. The add-on control technologies available for spreader stoker boilers are SNCR (selective non-catalytic reduction) and SCR (selective catalytic reduction). SCR was eliminated because of potential problems in finding a suitable location where flue gas temperature was 600-750°F, and because it would cost about double that of SNCR.

The SNCR options evaluated included the Thermal DeNOx (Exxon) process, utilizing ammonia injection, and the NOxOUT (Nalco Fuel Tech) process which utilizes urea injection. Monsanto obtained estimates from each vendor. The capital cost of these systems ranged from $793,000 to $1,060,000, with the resultant cost effectiveness of the NOxOUT process (recalculated by the Department) ranging from $3700 to $4521 per ton of NOx removed. These estimates are based on a boiler capacity factor of 100% (unrestricted operation). These estimates include the cost of increased maintenance and downtime of the boiler resulting from the use of

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[1] The Department's Conditional Approval issued June 22, 1987 and the EPA BIF regulations (40 CFR Part 266 Standards for Hazardous Waste Burning in Boilers and Industrial Furnaces) require that CO emissions be kept $\leq$100 ppmv (1 hour average) and $\leq$500 ppmv (10 minute rolling average), both at 7% O_2, while burning MRD. A continuous emission monitor and data logging system are used to monitor compliance with these CO standards while burning MRD. Any boiler tuning to further reduce NOx is constrained by these CO limitations which are in effect while burning MRD. Monsanto's use of MDR in Boiler #11 is declining, and will eventually be eliminated entirely.

SNCR.[2] They also include the cost of lost revenue from electric production and the extra cost of natural gas or #2 oil, which must be burned when Boiler #11 is out of service, compared to coal. See **APPENDIX C** for further details.

The Department agrees with Monsanto's conclusions regarding NOx RACT for the facility, and is of the opinion that the Emission Control Plan submitted for the implementation of NOx RACT at the Monsanto Company — Indian Orchard Plant conforms with the requirements of *Regulation 310 CMR 7.19: Reasonably Available Control Technology for Sources of Oxides of Nitrogen* of the "Regulations for the Control of Air Pollution in the Pioneer Valley Air Pollution Control District". Therefore the Department issues **FINAL APPROVAL** to the plan subject to the following provisions:

V. PROVISIONS OF APPROVAL

NOx Emission Limitations

1. Monsanto Company shall ensure that Boilers #9, #10, and #11 comply with the NOx emission limitations contained within the applicable sections of the Regulations and within this ECP. Monsanto Company shall ensure that these boilers comply with the NOx Potential Emission Limits established by this ECP.

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[2] The increased maintenance estimates of Monsanto were based on three additional boiler shutdowns per year each lasting 7 days. Boiler shutdowns are for cleaning anticipated hard salt buildups on economizer and preheater surfaces caused by reaction of urea/ammonia with sulfur oxides released during fuel combustion.

The frequency-of-cleaning was estimated by Monsanto based on information obtained during telephone conversations with management personnel at the Cogentrix coal fired facility in Richmond, Virginia. Additional information was obtained from an article entitled "NOx control system at cogen plant plagues downstream components" written in the December, 1994 issue of Power magazine.

The cost of control of NOx by SNCR exceeds $3000 per ton even if the number of additional outages required per year is decreased from three to two and the substitute fuel burned in boilers #9 & #10 is #2 oil. These boilers have the capability to burn #2 or #4 oil. However this capacity has not been used in 10 years, and the condition of the fuel left in the tanks and the condition of the fuel delivery system are unknown, as are the costs of preparing these systems for initial operation.

A summary of the applicable NOx Emission Limitations for Boilers #9, #10, and #11 is found in TABLE A.

TABLE A
NOx Emission Limitations
Boilers #9, #10, and #11 (coal boiler)

	BOILER #9	BOILER #10	BOILER #11
BOILER CATEGORY	310 CMR 7.19(4)(a)4.a. Large Boiler [1]	310 CMR 7.19(4)(a)4.b. Large Boiler [2]	310 CMR 7.19(12) Misc. RACT
NOx EMISSION LIMITS			
Natural Gas	0.30 lb/MMBtu	0.40 lb/MMBtu	NA
#2 Oil	0.30 lb/MMBtu	0.40 lb/MMBtu	NA
Coal	NA	NA	0.525 lb/MMbtu
POTENTIAL NOx EMISSIONS (tons/year at emission limit)	147 tpy	343 tpy	573 tpy

1 Large Boilers with heat release rate $\leq$ 70,000 Btu/hour-ft^3
2 Large Boilers with heat release rate $>$ 70,000 Btu/hour-ft^3.

CO Emission Limitations

2. Monsanto Company shall ensure that Boilers #9, #10, and #11 comply with the CO emission limitations established by this ECP and in TABLE B.

TABLE B
CO Emission Limitations
Boilers #9, #10, and #11

	BOILER #9	BOILER #10	BOILER #11
BOILER CATEGORY . .	310 CMR 7.19(4)(a)4.a. Large Boiler [1]	310 CMR 7.19(4)(a)4.b. Large Boiler [2]	310 CMR 7.19(12) Misc. RACT
CO EMISSION LIMITS (1 hour average) Natural Gas or #2 Oil	$\leq$ 200 ppmv @3% O_2	$\leq$ 200 ppmv @3% O_2	$\leq$ 100 ppmv @7% O_2 (cofired); otherwise $\leq$ 200 ppmv @3% O_2 [3]

1 Large Boilers with heat release rate $\leq$ 70,000 Btu/hour-ft^3
2 Large Boilers with heat release rate $>$ 70,000 Btu/hour-ft^3
3 The Department's air quality conditional approval of June 22, 1987, and the EPA BIF regulations (40 CFR Part 266 Standards for Hazardous Waste Burning in Boilers and Industrial Furnaces) require CO emission be kept $\leq$ 100 ppmv (1 hour average) and $\leq$ 500 ppmv (10 minute rolling average), both @7% O_2, while cofiring methanol rich distillate with coal. Otherwise the limit is $\leq$ 200 ppmv @3% O_2.

The CO limits for Boiler #11 (coal boiler) are part of this NOx RACT ECP Final Approval and will become part of the Massachusetts State implementation plan with the acceptance of this Final Approval by the USEPA.

3. Monsanto Company shall ensure that the #11 boiler operates with its controls set in accordance with the following requirements:

   a. boiler operation shall be set to automatic control, and
   b. boiler shall operate with overfire air, and
   c. boiler oxygen controller setpoint bias shall be set at 0.36 $\pm$ 0.05.

   Monsanto Company may petition the Department to modify the above boiler control settings in accordance with provision 4 of this **FINAL APPROVAL**.

4. Monsanto Company may operate with boiler controls set different than specified in provision 3 but only after receiving written approval from the Department. A request for such operation shall be made in writing to the Department and shall include a demonstration that NOx and CO will not exceed emission limits established in this approval while operating with the modified control settings.

   This demonstration need not entail testing as elaborate as a formal compliance test (submittal and written approval of stack test protocol, notifying the Department of the test dates, Department witnessing of the test, submittal of stack test report, Department review of stack test report and the issuance of correspondence documenting the stack test results) but must follow the applicable procedures established in Appendix A of 40 CFR Part 60.

   Monsanto Company may operate with modified boiler control settings for the purpose of making this demonstration, but only for a maximum of 8 hours on any one day and only long enough to document NOx and CO emissions in support of a request for modified operation.

   Once modified boiler control setting are approved by the Department, Monsanto Company shall conduct the next yearly compliance stack test utilizing these modified control settings.

Stack Testing Requirements

5. Monsanto Company shall comply with the NOx emission stack testing requirements for Boilers #9, #10, and #11 contained within all applicable sections of 310 CMR 7.19(13), including 310 CMR 7.19(13)(c) "Stack Testing". Monsanto Company shall perform yearly compliance stack tests on Boiler #11 identically to the requirements (at the time of this ECP approval) for Boilers #9 and #10. A summary of the applicable requirements is provided below:

   a. Submit a pretest protocol for the required emission test (NOx and CO) for review and written Department approval at least 60 days prior to

the anticipated date of testing. Include in the pretest protocol a description of sampling point locations, sampling equipment, sampling analytical procedures, and the operating conditions for the required testing.

b. Conduct compliance stack testing in accordance with procedures set forth in Appendix A of 40 CFR Part 60 or another method approved by the Department and EPA.

c. Perform the initial compliance stack test on Boilers #9, #10, and #11 before January 1, 1996.

d. Submit the emission test report for the review and written Department approval within 60 days of the completion of the compliance stack testing.

e. Perform the annual compliance test on Boilers #9, #10, and #11 prior to October 1 of each year beginning 1996.

Recordkeeping and Reporting Requirements

6. Monsanto Company shall comply with the NOx emission recordkeeping and reporting requirements for Boilers #9 and #10 contained within all applicable sections of 310 CMR 7.19(13), including 310 CMR 7.19(13)(d) "Recordkeeping and Reporting".

7. Monsanto Company shall perform the same NOx emission recordkeeping and reporting for Boiler #11 as is required for Boilers #9 and #10 as specified in the applicable "Regulations".

General Provisions

8. Monsanto Company shall maintain continuous compliance with the terms of this ECP at all times. Monsanto Company Boilers #9, #10, and #11 shall be operated in strict accordance with the plans and specifications submitted as part of the ECP approved herein. Furthermore, Monsanto Company shall demonstrate compliance with this NOx RACT ECP no later than May 31, 1995. Should there be any differences between the application materials and this approval letter, this approval letter shall govern. All notification and reporting requirements contained herein shall be directed to the Department of Environmental Protection, Bureau of Waste Prevention, Western Region unless otherwise specified.

Please be advised that the portion of this RACT approval pertaining to Boiler #11 is issued in accordance with the requirements of *Regulation 310 CMR 7.19 (12)*

Miscellaneous RACT and as such is a revision to the Massachusetts State Implementation Plan and must be submitted for approval to the USEPA as a source specific SIP revision.

This approval pertains only to the air quality control aspect of the proposal and does not negate the responsibility of the owners or operators to comply with other applicable state, local, or federal laws and regulations.

The Department has determined that the filing of an Environmental Notification Form ("ENF") with the Secretary of Environmental Affairs, for air quality control purposes, was not required prior to this action by the Department. Notwithstanding this determination, the Massachusetts Environmental Policy Act and Regulation 301 CMR 11.00, section 11.03, provide certain "Fail-Safe Provisions" which allow the Secretary to require the filing of an ENF and/or an Environmental Impact Report at a later time.

This **FINAL APPROVAL** is an action of the Department. There are limited rights of appeal. For a description of these rights, read the enclosure "APPEAL RIGHTS".

If there are any further questions or comments please contact John Kirzec of this office at (413) 784-1100 extension 225.

Very truly yours,

Mark Schleeweis
Permit Chief
Bureau of Waste Prevention
Western Region

JK/jk
monsant2.ecp
Enclosures

cc: Mary Holland, Regional Director, Western Region
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Attention: Susan Studlien, Acting Director

Springfield Board of Health