Inventory and Analysis of State Programs for the Remediation of Contaminated Soil and Groundwater Caused by Agricultural Waste

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This report explains these programs and the implementation experiences. The target audience is federal and state regulators, planners, and managers of agricultural chemical contamination. The report is available on the Internet at www.clu-in.org/studentpapers/.

About the National Network for Environmental Management Studies

The National Network for Environmental Management Studies (NNEMS) is a comprehensive fellowship program managed by the EPA's Office of Environmental Education. The purpose of the NNEMS Program is to provide students with practical research opportunities and experiences.

Each participating headquarters or regional office develops and sponsors projects for student research. The projects are narrow in scope to allow the student to complete the research by working full-time during the summer or part-time during the school year. Research fellowships are available in environmental policy, regulations, and law; environmental management and administration; environmental science; public relations and communications; and computer programming and development.

NNEMS fellows receive a stipend at a level determined by the student's level of education, the duration of the research project, and the location of the research project. Fellowships are offered to undergraduate and graduate students. Students must meet certain eligibility criteria.

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INTRODUCTION

Individual states have begun to initiate remediation at agrichemical sites where severe environmental degradation has occurred due to chronic spillage and improper disposal of crop production chemicals. Remediation includes, but is not limited to, the conduct of site investigations, preparation of work plans and reports, removal or treatment of contaminants, construction and maintenance of engineered barriers, and implementation of institutional controls. At least four states—Illinois, Michigan, Minnesota, and Wisconsin—have implemented programs to address contamination from agricultural activities.[1] These programs involve cleaning up contamination from pesticides and herbicides and the disposal of unused products. The programs are at different levels of development, so there is a variation in the amount of public information available about them.

An agricultural chemical incident is the release or threatened release of a pesticide or fertilizer into the environment that may cause adverse environmental effects. The first type is a sudden incident, such as a container rupture or transportation accident that is easily recognized and often cleaned up with minimal investigation and laboratory analysis. The second type is considered an historical incident, usually discovered by analysis of facility site soils or nearby ground or surface water. These incidents often are caused by small spills occurring over many years of site use and may accumulate and eventually cause significant environmental damage. In order to clean up the historical incident, the extent and magnitude of the contamination first must be defined through a remedial investigation.[2] State agencies and divisions in Illinois, Michigan, Minnesota, and Wisconsin administer agricultural waste cleanup programs. These programs are implemented to comply with state laws and regulations set forth by that individual state.

Innovative treatment technologies applicable to soil and sediment remediation include soil vapor extraction, solidification, bioremediation, soil flushing, thermally enhanced recovery, chemical treatment, phytoremediation, dual-phase extraction, electrical separation, and vitrification.

Innovative treatment technologies applicable to groundwater remediation include air sparging, bioremediation, dual-phase extraction, permeable reactive barrier, phytoremediation, chemical treatment, and in-well air stripping.

ILLINOIS

Agrichemical Facility Response Action Program (AFRAP)

Program Authority

The Illinois Department of Agriculture (IDOA) has authority over the Agrichemical Facility Response Action Program.

Program Activity

The AFRAP addresses the remediation of spills of all registered and cancelled pesticides at commercial sites where agricultural pesticides are stored and handled. The program establishes appropriate site-specific soil and groundwater cleanup objectives for the review and approval of voluntary corrective action plans. A notice of closure is issued upon successful completion of corrective action plans.[3] The program is divided into two parts or functions, each with its own perspective. The Agrichemical Facility Response Action Program is a facility cleanup program that provides participants with a means to transfer property liability. Liability assurance letters protect buyers and sellers from investing in property that is contaminated. The program was finalized in 1999. The second functional area of the AFRAP, The Land Application Authorization Program, which became effective in 1990, authorizes the IDOA to approve the land application of agrichemical-contaminated soils and groundwater at agronomic rates.[4]

Application Process

An owner or operator who elects to participate in the AFRAP must conduct a site assessment. Initial and final phase assessments must be completed, and, in some cases, a detailed assessment phase also must be completed. The purpose of the site assessment is to identify any pesticide contamination of soil or groundwater and to develop sufficient information regarding the extent of any contamination to guide decisions about corrective action. All site assessments must be conducted by, or under the supervision of, a licensed professional geologist, professional engineer, or licensed industrial hygienist.

The initial site assessment develops an appropriate sampling and analysis plan based on the environmental conditions at the agrichemical facility. A listing of target pesticides that must be considered is included in the initial assessment. These target pesticides are acetochlor, alachlor, atrazine, butylate, chlorpyrifos, carbofuran, 2,4-D, metolachlor, metribuzin, endimethalin, simazine, terbufos, and trifluralin. The final assessment will execute the sampling and analysis plan for the soil and groundwater at the site and determine the locations of the pesticide concentrations.[5] An optional detailed assessment is required only when an applicant proposes corrective action based on site-specific soil cleanup objectives rather than the default soil cleanup objectives. The detailed assessment will provide the information necessary for the calculation of site-specific soil cleanup objectives based on the site's physical properties.[6] Upon completion of the corrective action plan and recommendations by the AFRAP Board, the IDOA will issue a notice of closure stating that site-specific cleanup objectives have been met and no further remedial action is required.

To receive approval through the Land Application Authorization Program, the applicant must develop an appropriate site-specific list of agrichemicals released at the spill site.[7] The applicant devises a corrective action plan that includes analytical information, such as its intended application location and acreage, rate of application, and level of contamination. After the plan has been reviewed and approved, the IDOA will authorize land application consistent with the chemical's intended use.

Treatment Technology

Before the AFRAP was established, there was a site that used phytoremediation to remediate a spill.[8] However, the AFRAP only issues land application authorizations, so land application is the only treatment technology used. Determination of the most suitable remediation technique is subject to the requirements of the soil and groundwater cleanup objectives of Section 259.210 of the Illinois Administrative Code. If the pesticide concentrations in soil are equal to or greater than the specified remediation suitability determination levels, the soil is considered a high risk and will not be suitable for land application methods. Low levels of contamination may be safely land applied.[9]

Funding

The AFRAP is funded by Illinois' General Revenue Funds, U.S. EPA's Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) funds, and the State Pesticide Control Fund. The program does not offer financial reimbursement or assistance. For 1991, 1992, and 1993, an annual registration fee of $500 per agrichemical facility was imposed. The monies collected from the fees were deposited in the Agrichemical Incident Response Trust Fund, which is to be used in the event of a catastrophic incident only by those facilities that paid into the fund. Coverage under the fund begins after other insurance coverage has been exhausted. The total annual expenditures from the fund are not to exceed $120,000 and no funds will be disbursed from the fund when the balance is less than $750,000. Each claim submitted by an owner or operator to IDOA for approval is subject to a deductible of $50,000 of the amount approved plus 10% of the total response costs incurred by that owner or operator. The IDOA will not deduct more than $100,000 for each agrichemical facility. The deductible amount will apply annually for each agrichemical facility at which costs were incurred under a claim submitted.[10] To date, there has only been one withdrawal from the Fund.

Program Status

To date, no site has applied to the AFRAP program. There have been over 50 land application authorization requests.[11]

MICHIGAN

Michigan Groundwater Stewardship Program

Program Authority

The Michigan Groundwater Stewardship Program (MGSP) was established in 1994 with the passage of PAA 247 GWFWPA. The MGSP is administered by the Michigan Department of Agriculture (MDA).[12]

Program Activity

The MGSP is a voluntary, locally driven program designed to provide recommendations for assessing risk at sites that deal with products spilled during mixing/loading by maintaining a focus on the elements of education, technical assistance, and research.[13] The staff members coordinate pesticide and fertilizer responses on farms that do not present an imminent threat.[14] There are five major components of the program:

Groundwater Stewardship Teams are composed of farmers and representatives of county departments such as the local health department, extension, and soil conservation districts. These teams allocate grant money received from the Groundwater Stewardship Program according to local needs and interests.

The Groundwater Monitoring Program assesses groundwater quality for domestic well owners and evaluates the risk of groundwater contamination associated with different pesticides and fertilizers.

The Spill Response Team provides a 24-hour hotline for reporting agricultural pollution emergencies and for assessing technical assistance necessary to control, contain, and reduce environmental impacts associated with pesticide, fertilizer, and manure spills. The objective of the program is to achieve a minimum of 90% cleanup within the first 24 hours after the incident. This could involve providing technical assistance, project oversight, and information about notification channels or linkages to those who can provide an important service.[15] Financial assistance for dealing with the control, containment, and cleanup of a spill no longer is available.[16] Those involved in the incident are expected to use their own resources and equipment to complete remediation and to utilize land application for disposal/re-use.[17]

Farmstead Assessments (Farm*A*Syst) is a series of fact sheets and worksheets designed to identify risks posed by farmstead operations. Fact sheets provide educational information and a list of references that can be contacted if questions arise. The worksheets use a question-and-answer format to evaluate farmstead practices that may pose a risk to groundwater. The Farm*A*Syst is a voluntary and confidential program. The program only identifies risk and therefore cannot tell participants whether they have or ever will have contaminated water.[18] Farmers interested in hosting demonstrations or cost-share activities through the Groundwater Stewardship Program must complete the Farm*A*Syst program. Demonstrations illustrate a

variety of fertilizer containment operations for sound on-farm storage. Cost-shares provide varying levels of support for management practices.

Michigan Clean Sweep Program provides for the removal of pesticides and other agricultural chemicals from Michigan farms and disposes of them in licensed hazardous waste facilities. Outdated pesticides are accepted during collection days held throughout the state.[19]

Application Process

Parties interested in the MGSP can obtain a copy of the program materials applicable to their farm from the local Soil Conservation District, Extension Office, or a representative of the Michigan Groundwater Stewardship Program. A technician can help participants list high-risk activities and identify short- and long-term goals for risk reduction. These findings will be used to create a Groundwater Stewardship Plan for the participant's farm.

Treatment Technology

Appropriate technologies are chosen to remediate sites most effectively and at the lowest cost. Most efforts involve diluting the contamination to an acceptable level through land application processes. In the land application process, a manure spreader is used at agronomic rates until the contamination no longer poses a risk. The spills are mostly herbicides.[20]

Funding

Funds for the Michigan Groundwater Stewardship Program come from industry-supported pesticide and fertilizer registration and tonnage fees. Pesticide registration fees are paid by companies, which register both specialty (homeowner) and wide-area (agricultural, right of way, golf course, etc.) pesticides for use in Michigan.

Table 1. MGSP Pesticide and Fertilizer Registration/Tonnage Fees

Pesticides	**Registration/Tonnage Fees**
Specialty (Homeowner)	$100/product
Wide Area (Agricultural)	75% of the annual wholesale value, with a $150/product minimum
Fertilizers	**Registration/Tonnage Fees**
Specialty	$100/product and grade
Nitrogen	1.5 cents per percent of nitrogen in each ton

Pesticide registration fees account for about 74 percent of program revenues, with the remaining provided by nitrogen fertilizer users. Specialty products generate approximately 40 percent of the total revenues. The remaining revenues come from registration and tonnage fees from wide-area pesticide uses. Annual revenues average $3.5 million per year. Revenues not spent in one year are carried forward to fund the next year's programs and are not returned to the general fund.[21]

Table 2. FY2002 Grant Expenditures

Cost Share	$472,138
Technical Assistance	$988,324
Education/Demonstration	$118,745
Clean Sweep/Pesticide Container Recycling	$232,095
Total	**$1,811,302**

Source: FY2002 Fiscal Report sent by Jack Knorek, Land and Water Quality Manager, Michigan Department of Agriculture, July 16, 2003.

Program Status

There are 51 grant programs under the MGSP, representing 76 counties and nearly $2.6 million in funding allocations in FY2002. Grantees include conservation districts, Michigan State University (MSU) Extension offices, MSU researchers, and local non-profit organizations. Grant-funded activities include:

- Providing technical assistance and cost-share resources to support the voluntary adoption of groundwater stewardship practices, such as abandoned well closures, bulk fertilizer secondary containment structures, split nitrogen applications, nurse tanks and portable mix/load pads, intensive rotational grazing, and temporary pesticide storage.

- Assisting landowners and homeowners with completing groundwater risk assessments.

- Providing the means for individual Michigan residents to dispose of unused and unwanted pesticides by supporting Clean Sweep sites where these products are collected, packaged for shipping, and disposed of properly at no charge.[22]

The program inspected and registered over 240 businesses storing bulk liquid agrichemicals and provided cost-share and technical support to 21 farms across the state in constructing secondary containment facilities around existing on-farm bulk liquid fertilizer tanks. These demonstration sites are being used for educational purposes to illustrate a variety of fertilizer containment operations for sound on-farm storage.[23] There have been no collaboration efforts with any other states in this study.[24]

MINNESOTA

Incident Response Program

Program Authority

The Minnesota Department of Agriculture (MDA) is the lead agency for response to, and cleanup of, agricultural chemical incidents (pesticides and fertilizers) in Minnesota. The 1989 Minnesota Groundwater Protection Act granted the MDA the authority for agricultural chemical contamination cleanup under the Minnesota Environmental Response and Liability Act (MERLA– the Minnesota "Superfund"). The program operates under the primary authorities of Minnesota Chapters: 115B (MERLA), 18B (Pesticide Control Law), 18C (Fertilizer Law), 18D (Agricultural Chemical Liability, Incident, and Enforcement Law), and 18E (ACRRA).[25]

Program Activity

The MDA Incident Response Program focuses on four major areas: 24-hour emergency response, comprehensive facility investigations and cleanups, the Agricultural Voluntary Investigation and Cleanup Program (AgVIC), and the Agricultural Chemical Response and Reimbursement Account (ACRRA) program.[26] All reported incidents are evaluated by the emergency response program to determine if there is a need for immediate response. If immediate action is necessary, the emergency response staff will work directly with the responsible party to complete the investigation and cleanup. If the incident is determined to be stable and further investigation is necessary to determine its extent, the responsible party (or voluntary party) can choose either to enter the AgVIC Program, in which case the party will be billed for MDA staff time to oversee the investigation, or to go through the prioritization process and eventually to proceed through the Comprehensive Facility Investigation Program.[27]

24-Hour Emergency Response Team

The Emergency Response Spills Team provides emergency response support for agricultural chemical incidents. Spills, transportation accidents, fires, and other events which result, or threaten to result, in releases of pesticides and fertilizers into the environment must be reported immediately, contained, and cleaned up under MDA oversight and approval.[28] All agricultural chemical incidents should be reported to the state duty officer upon discovery. There is a limited exemption for reporting small spills (less than one acre-worth of product) by licensed or certified applicators. Failure to properly report an incident may jeopardize eligibility for partial reimbursement from ACRRA. New incident sites are identified in a variety of ways. These include incidents identified as a result of a spill; pre-construction sampling by a facility; site assessment sampling by a facility or a potential buyer; routine sampling by MDA inspectors; and third-party reports of contamination, such as dead vegetation on or adjacent to a facility, or sampling results of water supply wells.[29]

The following chart[30] presents an emergency case file outlining the events of a typical emergency response conducted by the MDA:

Emergency Case File	
Summary: In 2001, a trailer hauling a 1,000-gallon tank of urea ammonium nitrate fertilizer had a flat tire causing the tank to slip off into the ditch. The spill was approximately 800 gallons of liquid fertilizer. Sixty yards of soil was excavated and landspread onto 18 acres during the fall 2001.	
Timeline	
2001	The responsible party notified the duty officer about the spill.
	MDA completed a review of the case file (follow-up to incident reported).
	Corrective Action reimbursements issued for cleanup consultant services, laboratory analyses, and land application.
	Completed land application for incident.
	Completed a review of the case file and concluded that the site was adequately remediated.
Proposal to Land Apply Soil from Agricultural Chemical Emergency Incidents	
The proposal is for MDA use only. The form includes: responsible party information, proposed land application site information, and application rates (product name, total quantity released, application rate, and acreage needed.)	
Application for Reimbursement	
The data provided on the application for reimbursement are used to assess the site's eligibility for ACRRA reimbursement.	
The following information is needed for the ACRRA application: general information, applicant information, contact information, remediation activities, contractors/consultants information, eligible costs summary, and names of other financing sources.	
The eligible cost categories include: cleanup consultant services, soiling boring and well monitoring, laboratory analyses, equipment, rental/leasing/purchasing, excavation, trucking, land application, site restoration/backfill, and other costs (permits, fire department fees, etc.)	
Total ACRRA Reimbursement: $352.80	

Comprehensive Facility Investigation Program

The Comprehensive Facility Investigation Program oversees cleanup of sites that have been historically contaminated by agricultural chemicals. The program will identify the site and responsible party(ies); manage the investigation to determine the scope and extent of contamination; and request, or in some cases perform, remediation.[31] A comprehensive facility investigation will be requested for a high-priority site. The facility will receive a formal letter of request to conduct the investigation. Generally, the MDA project manager will call the facility and may arrange a visit to the site prior to sending the letter of request.[32]

The following is a summary of a case study[33] that was initiated after contamination was discovered through sampling conducted prior to construction of new bulk chemical containment. There was contamination discovered through this sampling. The investigation and eventual cleanup of the construction area was conducted by the MDA emergency response staff. After land application, the contamination from this area was prioritized to determine the need for further investigation of the entire facility. As a result of this prioritization, the case eventually was reopened through the Comprehensive Facility Investigation Program.

Historic Case File	
Summary: In 1992, the MDA was contacted about pre-construction sampling done at a site. Initially, the site was a dry fertilizer dealership that began handling and distributing liquid fertilizer. Soil excavation was initiated and completed, preempting submission of a landspreading proposal. A case file closure letter was sent. It was noted that the file could be reopened for future work. ACRRA Board approved reimbursement for excavation activities.	
Timeline	
1992	Pre-construction sampling and excavation.
1993	The excavated soil was landspread. (The case was closed.)
1998	The file was reopened for further work.
1998	The work plan was submitted.
1998	The Remedial Investigation Report/Corrective Action Plan was submitted.
1999	The Corrective Action Report was submitted.
1999	The Remedial Investigation Work Plan (RIWP) was submitted.
1999	Quality Assurance/Quality Control data reported.
1999	Groundwater Monitoring Report
2000	Groundwater Report
2001	Groundwater Report
2002	Groundwater Report
2003	Groundwater Report
Phase One	
Pre-construction soil sampling at site revealed bulk chemical/liquid fertilizer dike contamination.	
Approximately 1,180 cubic yards of soil were landspread.	
The landspreading application summary includes: source and volume of soil, crop, acres to be used, application rate, and equipment.	
Phase Two	
The case was reopened for further work. There is a telephone call record that includes whether MDA agrees or disagrees with the consultant recommendations and has suggestions.	
Weather history shows that the nitrate concentrations tend to increase at times when precipitation increases, specifically in the spring. The MDA scheduled a site visit to discuss possible sources for the high nitrates in the monitoring wells.	
Groundwater and soil contamination remained a concern at the site; therefore, staff requested a site investigation and corrective action.	
Once the sample areas are identified, a work plan is needed.	
Phase Three	
Work Plan: Includes introduction, scope of work, site description, historical land use, soil sampling history, regulatory review, on-site observation, off-site observation, recommendation by area, soil sampling, and contamination impacts survey.	
Remedial Investigation Report/Corrective Action Plan: Includes introduction, site description, historical land use, sampling history, remedial investigation by area, cleanup goals for site, recommended corrective action, soil handling, and limitations.	
Corrective Action Report: Includes introduction, corrective action results, comparison of laboratory and field statistics, and soil disposal.	

Remedial Investigation Work Plan (RIWP): RIWP was approved and conducted. Remedial Investigation Report/Corrective Action Plan (RI/CAP) Report was prepared following completion of remedial investigation activities. RI/CAP and Corrective Action Reports were approved. A completed landspreading proposal was approved for over 496 acres of land. Each area contains a map with location of contaminant and its composite.
Quality Assurance/Quality Control Data: Includes compound, extraction method, analysis method, analysis date, dilution factor, sample result, and reporting limit.
Groundwater Monitoring Report: Includes introduction, well installation, sampling procedures and analytical results, recommendations, and imitations. Presents a description of the monitoring well installation and monitoring well sampling. Well locations are based on the anticipated shallow groundwater flow direction and on-site activities. Recommended several additional groundwater samples on a quarterly basis to evaluate contaminant level trends/rising/falling.
Total ACRRA Reimbursement: $22,000

Once an incident is documented and properly reported, the costs incurred in conducting an approved investigation and cleanup in the Comprehensive Facility Investigation Program generally are eligible for ACRRA reimbursement. Government subdivisions and certain other parties are not eligible to apply for ACRRA reimbursement.

Agricultural Voluntary Investigation and Cleanup (AgVIC) Program

Before a file is prioritized, the facility owner or other responsible party can opt to enter the MDA Agricultural Voluntary Investigation and Cleanup (AgVIC) program. The AgVIC is designed to provide rapid response and a high level of service for property transfers, business transactions, and other voluntary actions.

The AgVIC program provides review of the environmental investigation and cleanup work (if needed) on farms, at retail facilities, or at any properties with possible agricultural chemical contamination. AgVIC will then issue legal liability assurance letters documenting that state requirements have been met. Each AgVIC project is tailored to the specific needs and deadlines of the voluntary party. AgVIC staff can provide binding written assurances from MERLA liability. AgVIC staff are funded by MERLA, which requires that MERLA expenditures be recovered. Therefore, voluntary parties must agree to reimburse AgVIC staff costs into the state MERLA account (at a rate of $100/hour).[34]

Landowners and operators who are not selling their property but who are aware of documented agricultural chemical contamination on their site also can enter the AgVIC program for an accelerated cleanup. Contamination on a property may be documented through routine inspections or other means. Once contamination is documented, any construction, improvement, or soil disturbance in the contaminated area may affect liability issues and could increase cleanup costs. To avoid limitations on property use or management, an expedited cleanup of the contaminated area may be completed through the AgVIC program. Liability assurance letters would be available after the environmental cleanup is complete.

Any individual or firm that is willing to conduct an investigation and possible cleanup of a property is eligible to enter the AgVIC program. AgVIC staff routinely provide assistance in the investigation and cleanup of properties that are not high in priority for the MDA to address in the

ordinary administration of the Incident Response Program, as well as those properties that are in the process of a property transaction and therefore cannot wait for the prioritization process. Once an incident is documented and properly reported, the costs incurred for an AgVIC-approved investigation and cleanup generally are eligible for ACRRA reimbursement. Government subdivisions and certain other parties are not eligible to apply for ACRRA reimbursement.

Treatment Technology

The state of Minnesota has allowed the land application of pesticide- and fertilizer-contaminated soil. A written land application request must be submitted for approval. An authorization for land application must prescribe appropriate application rates and other operational control practices to protect human health and the environment and must identify sites where land application is to be performed.

The first choice in soil remediation is land application.[35] Land application is an inexpensive and efficient treatment alternative for the remediation of pesticide- and fertilizer-contaminated soil associated with the cleanup of agricultural chemical facility sites. Land application is preferred for several reasons. The practicality and financially low cost of the process is efficient.[36]

According to Roger Mackedanz, Minnesota has successfully used many other treatment technologies even though land application usually the "cheapest and is an environmentally sound" technology.[35] Treatment technologies used to date include *in situ* bioremediation, biopiles, and phytoremediation, to mention a few. *In situ* bioremediation has been used at wood treatment sites. Another site used a combination of a biopile and subsequent land application. The contaminant concentration was too high to be landspread. The contaminated soil was placed into a biopile where it was managed for two seasons to reduce the contamination low enough to be landspread. Phytoremediation was performed at a site that was highly contaminated with nitrogen, where alfalfa was planted to remove contamination. After the plant uptake of the nitrogen, the alfalfa was harvested to remove the nitrogen. Another site used poplar trees in the phytoremediation process.

Many sites have impacted groundwater, but the contamination does not always lead to extensive groundwater cleanup. The groundwater contamination case depends on the receptor. In some cases, the source of contamination is removed through soil excavation and the contamination in the groundwater is allowed to naturally attenuate. At a northwest Minnesota site with nitrogen contamination, the groundwater is collected in the shallow aquifers through a series of tile lines stored in above-ground tanks and eventually landspread. The type of remediation depends on the contaminant or mixture of contaminants. If the contaminant label cannot be determined or followed, another technique will be used because land application must follow the label.[37]

Agricultural Chemical Response and Reimbursement Account (ACRRA)

The Agricultural Chemical Response and Reimbursement Account (ACRRA) was established by the 1989 Minnesota Groundwater Protection Act to provide financial assistance to clean up agricultural chemical (pesticide and fertilizer) contamination.

Program Authority

The Agricultural Chemical Response Compensation Board administers the ACRRA Fund and determines reimbursements or payments from the fund to eligible persons. The five-member board consists of representatives of the agricultural chemical registrants, manufacturers and dealers, farmers, the Department of Agriculture Commissioner, and the Department of Commerce Commissioner.[38]

Application Process

Applicants must completely fill out the ACRRA reimbursement application, attach supporting documents, and submit them to the ACRRA Program. The completed application must be received at least 60 days prior to the next board meeting to be considered for reimbursement at that meeting. Applications must be submitted within 3 years of incurring eligible costs or approval of corrective action design, whichever is later. The Board reviews the application, decides whether to order payment, and determines the amount. Requests for reimbursement may be considered by the Board once every 12 months if costs incurred are $5,000 or less, or every other meeting if over $5, 000. Before any reimbursement can be made, the ACRRA Board must determine the following:

- The MDA was given proper notice of the incident, as required (Minnesota Statutes, Chapter 18D);
- The cost of investigation and cleanup were reasonable and necessary; and
- The eligible person complied with corrective action requests or orders issued by MDA, or the eligible person took all reasonable action necessary to minimize and abate the incident, and the corrective action was subsequently approved by MDA.

If these conditions are met, the Board may reimburse corrective action costs to an eligible person for 80% of costs greater than $1,000, up to $350,000. The Board is limited to a maximum reimbursement of 60% if re-contamination from a subsequent incident exists. In addition, they have the authority to reduce reimbursement or payment if a portion of the incident was caused by a violation of Minnesota Statutes, Chapter 18B, 18C, or 18D.[39]

Funding

The ACRRA allows for the reimbursement of up to $279,200 of corrective action costs for each agricultural chemical incident. The first $1,000 must be paid by the eligible party. The fund then covers up to 80% of the eligible costs between $1,000 and $350,000. Reimbursement decisions are made by an independent board that includes industry representatives. An eligible party may apply for reimbursement when the plan for corrective action (cleanup) is approved, even if the corrective action is not actually under way. There also is a provision for advance payment of

costs incurred if the party is unable to pay. To be eligible for ACRRA, the incident must be properly reported, the work must be approved by MDA staff, and the facility should be in compliance with all relevant laws. The fund pays only for corrective action costs. Attorneys' fees and third-party review costs are not eligible. [40]

The ACRRA is funded through annual surcharges on pesticide and fertilizer manufacturers, distributors, applicators, and dealers. If the ACRRA fund balance drops below $2 million, no single eligible person may receive a reimbursement exceeding $100,000 within a single fiscal year.[41] The Commissioner of Agriculture determines the surcharge rate based on the revenues needed to maintain a sufficient account balance, the estimated amount needed for response to incidents, and the estimated amount needed for reimbursement or payment to eligible persons.

Table 3. ACRRA 2002 Surcharges

Pesticide Registration (Annual gross sales)	0.30%
Fertilizer Tonnage	$0.30/ton
Commercial and Non-Commercial Pesticide Applicator Licenses	$60
Pesticide Dealer License (Restricted Use 7 Bulk Pesticides/per site)	$225
Lawn Service- Fertilizer	$225
Agricultural fertilizer License	$225
Structural Pest Control License (Company license)	$150
Out of State Pesticide Distributors	$3,000

Source: http://www.mda.state.mn.us/appd/acrra/annualreport.pdf: 7/9/03 page 1.

Table 4. Revenue in Year 2002

Revenue	Year 2002
Pesticide Registration	47%
Fertilizer Tonnage Fees	17%
Commercial Pesticide Applicator License	13%
Fertilizer Fixed Facility Fees	12%
Other	12%

Source: http://www.mda.state.mn.us/appd/acrra/annualreport.pdf: 7/9/03 page 4.

Program Status

The AgVIC Program has over 100 cases since 1993. In comparison, the Comprehensive Investigation Cleanup Program has about 70 cases.[42] The ACRRA Board authorized funding of 67 applications for agricultural chemical incident corrective action costs for FY2002. Over its 13-year history, the ACRRA has disbursed $16,771,209 to cover eligible corrective action costs at 313 sites. Of the 313 sites funded by ACRRA, the Incident Response Program has closed 238. Total cleanup disbursements for FY2002 were $2,391, 027. The amount of individual authorized disbursements ranged from $1,000 to $189,100. The FY2002 ACRRA surcharge revenue was $2,289,110. The account had a $276,917 deficit in FY2002, despite the increase in surcharges.[43] The ACRRA fund has not run out, but the balance has been low due to the increase in voluntary applicants. Due to the increase in the cleanup program and the restructuring

of the reimbursement program, legislation has created a rule that allows the ACRRA Board to reimburse only $100,000 per claim each year if the fund balance falls below $2 million. Thus, if the cost of a reimbursement is $200,000, money will be disbursed over a two-year period.[44]

Table 5. ACRRA Expenditures and Revenue Summary

Fiscal Year	Expenditures	Revenues
1998	$1,745,515	$1,301,864
1999	$2,186,274	$1,301,179
2000	$1,591,765	$1,073,705
2001	$2,624,785	$1,976,704
2002	$2,566,027	$2,289,110

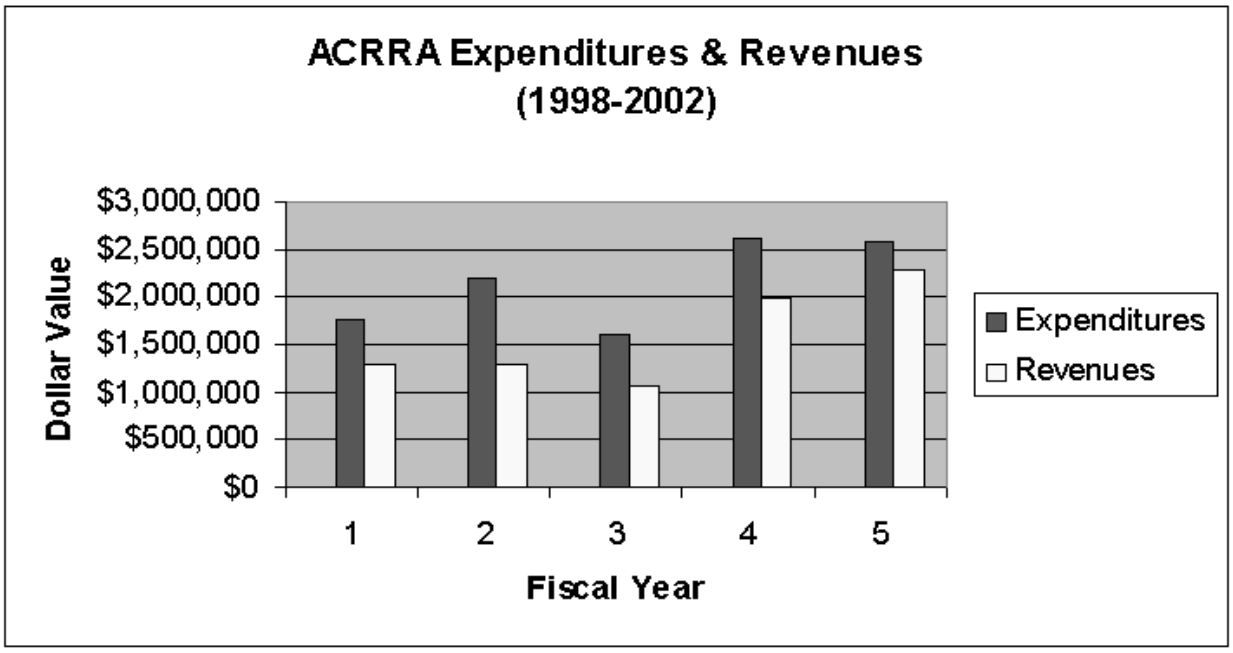

Figure 1. ACRRA Expenditures and Revenues

WISCONSIN

Wisconsin Agricultural Chemical Cleanup Program

Program Authority

The Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) has authority over the Agricultural Chemical Cleanup Program.

Program Activity

The Agricultural Chemical Cleanup Program addresses cleanup of long-term and acute spills of pesticides and fertilizers. The program has two separate functions. First, the program identifies and helps manage the cleanup of releases of pesticide and fertilizer spills to prevent these products from reaching the groundwater. Once a site has been identified as needing a cleanup, the ACCP program provides reimbursement for eligible costs incurred by the responsible persons. There is no voluntary cleanup program at this time.

Application Process

Persons who own or control spilled agricultural chemicals, persons causing the spill, or the property owner where the spill occurred are eligible for these funds. Municipalities are not eligible, even if they caused the spill.[45]

Treatment Technology

There were 270 active remediation cleanup cases last year. The sites were primarily landspread or landfilled. Less than 10 of the cases were groundwater-related.[46] There are several active cases that have used treatment technologies other than land application:

- Phytoremediation: 6-10 instances
- Bio-augmentation: 1 instance
- Irrigation with fertilizer contaminant: 2 instances
- Mixing makeup water, then reapply: 1 instance

Phytoremediation is being tried to remediate one small and one large site contaminated with nitrogen. Most of the soil was excavated with a backhoe but the residual contamination was left near a drainage ditch. Phtyoremdiation was chosen as the next step in remediation. The small site was lined with hybrid poplar and willow trees. About 95% of the plants died. Fifteen of the 128 installed plants grew.

Approximately 50 hybrid poplar trees, 50 willow trees, and prairie plants were replanted to continue phytoremediation efforts at that site. The phytoremediation portion of cleanup at the large site was estimated at about $35,000, attributable to the number of plants, ground preparation, groundwater monitoring, and excavation.[47]

The most common treatment technology is to landspread. DATCP has developed its own land application approach by using the pesticide label that the EPA approves at standard agronomic rates. Acute spills are easier to address than long-term releases because there generally is a known volume of product released and the cleanup usually is conducted soon after the spill occurs. Cleanup involves prompt excavation of the spill area and soil samples to ensure the spill has been adequately recovered. The contaminated soil is then landspread to a field where the product would normally be applied. Long-term releases take more time to clean up and can be more expensive.

The most common cleanup approach includes the following steps:

- Investigate the site to determine the extent of soil contamination at the property. The average cost for this phase is $14,800.
- Excavate and dispose of the contaminated soil. The most common method for soil disposal is to landspread the contaminated soil on the fields where the products are originally intended to be placed. The average cost for this phase is $40,200.
- Investigate the level of groundwater contamination and determine whether any receptors are at risk of exposure. This is done through installation of monitoring wells. The average cost for this phase is $24,500.[48]

Funding

The ACCP Fund uses funds collected from industry fees or surcharges to pay reimbursements for agricultural chemical spill cleanups under §§94.73, *Stats*. Collecting surcharge fees for this program resumed in FY2001 and 2002. While statutes require DATCP to maintain a fund balance between $2 million and $5 million, the fund dropped from above the maximum to below the minimum in a single year. Even with the resumption of fees at the maximum level in FY2002 and 2003, the fund will be unable to maintain the statutory minimum balance. Although not all fees were collected during FY2001 and 2002 and not all fees were collected at the maximum level, the maximum fees will apply for subsequent years. The table below shows the actual fees collected during FY2001 and 2002. The amount shown in parenthesis is the maximum fee levels that become effective for products sold late in FY2001 and 2002. However, these fees are not actually paid into the Fund until FY2002/2003.[49]

Agricultural Chemical Cleanup Program Surcharges

There is no specific surcharge rate. The surcharge rates are based on each product and the sale of that product.[50]

Table 6. FY 01/02 Agricultural Chemical Cleanup Fund

Source	Surcharge	FY2001/2002 Revenue
Fertilizer License	$0 ($20 if no pesticide license)	$0
Fertilizer Tonnage	$0 ($0.38/ton)	$0
Pesticide Application Business	$55	$80,465
Pesticide Dealer-Restricted Use	$40	$14,680

Source	Surcharge	FY2001/2002 Revenue
Pesticide Individual Applicator	$20	$109,540
Pesticide Registration Non-Household $0-25,000	$5	$17,570
Pesticide Registration Non-Household $25,000-75,000	$170	$37,060
Pesticide Registration Non-Household 〉$75,000	0.75% of sales (1.1% of sales)	$1,201,930
Interest on ACCP Revenues		$72,719
Total Revenues		$1,533,964
Expenditures (ACCP Reimbursements)		($3,558,557)

Source: E-mail from Duane Klein, ACCP Section Chief, Wisconsin Department of Agriculture, Trade, and Consumer Protection, July 16, 2003

Table 7. ACCP Remediation and Reimbursement Activity Cost Summary

Year	Reimbursement amount paid out
Pre-1996	$944,143
1996	$1,167,434
1997	$1,388,933
1998	$1,840,766
1999	$3,016,506
2000	$2,194,338
2001	$4,141,187
2002	$4,210,592

The reimbursement amount provided by the ACCP depends on who is conducting the cleanup and the circumstances of the spill. There is a deductible within the ACCP. For licensed applicators and commercial facilities, DATCP reimburses 80% of approved costs between $7,500 and $400,000. For private applicators, DATCP reimburses 80% of approved costs between $3,000 and $400,000.[51]

The ACCP Fund is used exclusively for partial reimbursement of cleanup costs incurred by agricultural coops, farm centers, and farmers (as well as other distributors and consumers of fertilizers and pesticides). Initially, these reimbursements were subsidized with a nearly 50% match of state general purpose revenues. Maximum ACCP surcharge fees are established by statute, but statutes direct DATCP to adjust fees as needed to maintain a fund balance of between $2 million and $5 million. Surcharge fees recently resumed at the maximum level allowed by the statute. Even at this maximum level, the deficit within the ACCP Fund is growing. By the end of FY2003, the fund will run out of money. [52]

Program Status

Since the ACCP program was initiated in 1994, more than 280 facility-related cleanups were begun and 170 were closed out. In addition, the state of Wisconsin has responded to and closed out over 99% of the 565 reported spills of agrichemicals. Over the years, more than 380 reimbursement applications were received and $14.5 million in payments were made.[53] Most of the reimbursement funding goes to long-term cases. During calendar year 2002, the ACCP received 69 claims for reimbursement totaling $4,042,117, and disbursed $4,210,592 in reimbursement payments.[54] The ACCP generated 37 new cases and closed 3 cases, which brought the number of active cleanup cases to 268. In addition, the ACCP responded to 49 spills and closed 36 of them. Eight cases from the previous year also were closed. The remaining open spill cases will be closed following completion of investigative and remedial actions and landspreading of contaminated soil.[55]

There was collaboration with Minnesota in the beginning phases of the program implementation. ACCP Section Chief Duane Klein feels that there is still a need to meet with other states. Currently, there is no technical help from other sources.

Table 8. ACCP Remediation Activities

Activity	Pre-1996	1996	1997	1998	1999	2000	2001	2002
Long-term cases generated	224	36	54	41	40	28	18	37
Total active long-term cases	112	125	153	177	198	220	234	268
Long-term cases closed	112	23	26	17	19	6	4	3
Total closed long-term cases	112	135	161	178	197	203	207	210
Spill cases generated	173	90	84	61	70	55	37	49
Spill cases closed same year as spill	-	50	58	38	53	38	32	36
Total spill cases closed each year	134	203	297	375	457	510	558	602
Spill cases transferred to long-term	36	5	6	2	5	3	0	0
Claims received	47	35	46	46	54	80	79	69

Source: E-mail from Duane Klein, ACCP Section Chief, Wisconsin Department of Agriculture, Trade, and Consumer Protection, July 16, 2003.

DISCUSSION

Review of the state agricultural waste cleanup programs in Illinois, Michigan, Minnesota, and Wisconsin shows that collaborative efforts by all parties involved will strengthen the overall success of the initiatives in those states. Collaboration will provide state agencies with the means to share expertise at varied levels of program implementation. The programs have a common goal, which is to minimize the risk of contamination to groundwater and soil through the use of effective treatment technologies. The remediation process usually begins with a site investigation or analysis, followed by submission of a corrective plan, review of the plan, and awarding of financial assistance to an eligible person. The states reviewed in this study have different standards but use the same technique for remediation. Almost all of the sites use land application to remove and prevent further contamination at the sites of interest. Further analysis reveals that financial reimbursement has a strong impact on the potential for enrollment into these programs.

Program Authority

The agriculture department of each state has primary authority over the pesticide and fertilizer spills programs. Each state has cleanup programs in other state agencies that are characterized as comprehensive land or groundwater cleanup programs that address all chemicals. For example, Michigan has a groundwater stewardship program that addresses only risks to groundwater. This means that the MDA does not perform remediation activities. However, Michigan's Department of Environmental Quality has a comprehensive cleanup program that addresses all chemical release incidents. The release notification requires residents to immediately report pesticide releases to the Pollution Emergency Alerting System.

Program Activity

Illinois has developed the foundation for a cleanup program similar to Illinois EPA's Site Remediation Program. Illinois EPA develops remediation objectives for contaminated soil and groundwater through the Site Remediation Program's Tiered Approach to Corrective Action Objectives (TACO). Each successive tier of the TACO's three-tiered approach allows more information to be used to develop remediation objectives. The Illinois AFRAP approach uses the same equations from the TACO with specific numbers that are tailored to the agrichemical industry. With help from programs that have been in existence longer than the AFRAP, the Illinois Department of Agriculture will be able to find the element that will spur AFRAP enrollment. Illinois's Agrichemical Incident Response Fund provides safeguards in the event of catastrophe. A constant financial disbursement such as a reimbursement program may be an the element that would produce enrollment into the AFRAP.

Michigan's Department of Agriculture has implemented a five-component program that only serves as a tool to reduce risks associated with agrichemicals. Their approach incorporates educational resources to reduce the number of incidents by providing residents with information about how to prevent spills from occurring. Education, technical assistance, and research helps provide information on new remediation methods as they evolve so that the most appropriate technology, rather than a standard remediation process, can be chosen when appropriate. Duane

Klein, ACCA Section Chief, Wisconsin Department of Agriculture, believes that an educational component would help his state's cleanup program.

Minnesota was the first state to create a cleanup and reimbursement program. The Minnesota Department of Agriculture was able to effectively address the needs of the agrichemical industry by incorporating all the elements that are present in the other programs in this study.

Wisconsin and Minnesota have similar program activities. Both programs offer the partial reimbursement option.

Application Process

All programs are voluntary, but the responsibility to report the incident is mandated by law in each state. The responsible party must first report the spill to the state's Department of Agriculture. Cleanup objectives are developed upon conducting a site investigation. If the party that is providing oversight approves the cleanup goal established for that site, cleanup activities will be performed and documented. Eligible costs for reimbursement include consultant fees, sampling and analysis, installing monitoring wells, and removing and treating contaminated soils. Ineligible costs may include attorney fees, loss of income, replacement of the spilled chemical, and decreased property values.

Funding

General funds or pesticide and fertilizer registration and tonnages fees support the activities of these cleanup programs. Companies, manufacturers, distributors, applicators, dealers, commercial fertilizer blending facilities, commercial pesticide application businesses, and farm sites that register pesticides and fertilizers for use pay the fees. The amount of fees varies depending upon the state. Illinois has several funding sources that support AFRAP and its staff of 1.5 to 2 full-time-equivalent employees. The program does not have direct state support in terms of reimbursement. Michigan generates an average of $3.5 million per year in revenue and expended close to $2 million in FY2002. Michigan and Minnesota both provide reimbursement for corrective action activities. They have collectively run out of, or will run out of, funding.

Treatment Technology

All of the states in this study use landspreading as its primary means of remediation. Landspreading, also known as land treatment, land application, or land farming, is a managed treatment and ultimate disposal process that involves the controlled use of the contaminant as a pesticide or as a treatment method for the pesticide residue in the excavated soil. The waste is spread on agricultural or non-cropped land to stimulate degradation, transformation, or immobilization of contaminants. The contaminated soil is spread thinly on agricultural topsoil, usually at a thickness of a fraction of an inch. Usually, the contaminated soil subsequently is incorporated into the upper six inches of topsoil. The pesticides then are degraded to non-toxic products.[56]

Before the advent of AFRAP, Illinois tried phytoremediation on a site in Cantrell, Illinois.[57] Phytoremediation is a process that uses plants to remove, transfer, stabilize, or destroy

contaminants in soil, sediment, and groundwater. The mechanisms of phytoremediation include enhanced rhizosphere biodegradation, phytoextraction (also called phyto-accumulation), phyto-degradation, and phyto-stabilization. Enhanced rhizosphere biodegradation takes place in the soil immediately surrounding plant roots. The most commonly used flora in phytoremediation are poplar trees, primarily because the trees are fast-growing and can survive in a broad range of climates. In addition, poplar trees can draw large amounts of water (relative to other plant species) as it passes through soil or directly from an aquifer. This may draw greater amounts of dissolved pollutants from contaminated media and reduce the amount of water that may pass through soil or an aquifer, thereby reducing the amount of contaminant flushed though or out of the soil or aquifer. Phytoaccumulation is the uptake of contaminants by plant roots and the translocation/accumulation (phytoextraction) of contaminants into plant shoots and leaves. Phytodegradation is the metabolism of contaminants within plant tissues. Plants produce enzymes, such as dehalogenase and oxygenase that help catalyze degradation. Investigations are proceeding to determine if both aromatic and chlorinated aliphatic compounds are amenable to phytodegradation. Phytostabilization is the phenomenon of production of chemical compounds by plant to immobilize contaminants at the interface of roots and soil.[58]

Biopiles are excavated soils that have been mixed with soil amendments and placed in an aboveground enclosure. It is an aerated static pile composting process in which compost is formed into piles and aerated with blowers or vacuum pumps. The soil amendments are placed on a treatment area that includes leachate collection constituents in excavated soils through the use of biodegradation. Moisture, heat, nutrients, oxygen, and pH can be controlled to enhance biodegradation. The treatment area generally will be covered or contained with an impermeable liner to minimize the risk of contaminants leaching into uncontaminated soil. The drainage itself may be treated in a bioreactor before recycling.[59]

Biocomposting involves excavating contaminated soil and mixing it with bulking agents and organic amendments such as wood chips, hay, manure, and vegetative wastes. Proper amendment selection ensures adequate porosity and provides a balance of carbon and nitrogen to promote thermophilic, microbial activity.[60]

CONCLUSION

The intention of this report is to stimulate interest in advocating more effective, less costly approaches to remediation in the agricultural industry. The quantity of available data during the time of the study was limited in some states. As a result, it is difficult to draw definitive conclusions on the effectiveness of one program compared to another. This report provides an overview of the provisions in each state program, and in some cases, the reader will find components in one program that are absent in another. The results do not suggest that one program is stronger than other. From the available information, it is possible to conclude that each state has implemented a program that is consistent with its own regulations and standards.

The department of agriculture in each of the four states in the study has tailored its program to accommodate the practices that are unique to that state. For example, Michigan does not have a pesticide-specific program that actively engages in the implementation of remediation technologies. However, like the other three states, Michigan has a comprehensive program for cleanup of all chemicals of contamination through other state agencies. Consequently, it is important to include the MGSP in this report because the activities that are coordinated through the program provide residents with tools to reduce the number of incidents through safer farm management practices. The agricultural waste remediation programs in Illinois, Minnesota, and Wisconsin seek to provide owners and operators of agricultural facilities with a means to conduct and pay for remediation at the site for which they are responsible. Remediation may include technical advice, financial assistance, educational outreach, emergency hotline availability, investigational assistance, and most importantly, technological application.

Site contamination varies, so individual sites must be sampled and remediated on a site-specific basis. All of the voluntary cleanup programs require site sampling or analyses to be conducted in accordance with state regulations in the area of concern. Minnesota provides guidance documents for every aspect of the remediation process. In general, these states land apply contaminated soil when applicable. The cost of remediation depends upon certain variables, including the size of the site, the type of remediation instituted, concentration of contamination, depth of contamination, and the extent of sampling. Typical site remediation technologies such as landspreading, *in situ* bioremediation, phytoremediation, biocomposting/piling, and natural attenuation reduce the level of contamination. Therefore, selection of the best technology depends on the availability of site-specific information. With the department's oversight, remedial activities are completed and in some instances, a no-further-action (NFA) letter is issued. The NFA letter does not confirm that contamination is no longer present, but it does suggest that contamination at the site does not exceed the soil objectives set forth by the department.

It has been suggested that increased enrollments in the Minnesota programs may be due to the reimbursement incentive provided by the ACRRA. The validity of this statement is apparent due to the fact that over the years, ACRRA-like programs in Iowa, Kansas, and Wisconsin have been created. Feedback from interviews with people who play major roles in the success of these programs proves that learning from the experiences of other cleanup programs will significantly help save time and money in the long run. The challenge is to develop the most efficient cleanup program that reduces the number of risks associated with agricultural waste.

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