Drycleaner Remediation Programs:
AN OVERVIEW AND CASE STUDIES

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NOTICE

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FOREWARD

EPA's Technology Innovation Office (TIO) provided a grant through the National Network for Environmental Management Studies (NNEMS) to assess the status of state drycleaner remediation programs and cleanups. This report was prepared by a graduate student from the University of Michigan during the summer of 2001.

About the National Network for Environmental Management Studies (NNEMS)

NNEMS is a comprehensive fellowship program managed by the Environmental Education Division of EPA. 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 determined by the student's level of education and the duration of the research project. Fellowships are offered to undergraduate and graduate students. Students must meet certain eligibility requirements.

About this report

This report is intended to provide an overview of the drycleaner remediation programs in Kansas, Oregon and Wisconsin, an analysis of the common program strengths and weaknesses, and case studies documenting drycleaner site cleanups within these states. It contains information gathered from a range of currently available sources, including project documents, reports, state program literature and outreach documents, Internet searches and personal communication with involved parties. No attempts were made to independently confirm the resources used.

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OVERVIEW

The notion that parties should pay to clean up the pollution that they release to the environment underlies remediation legislation at both the federal and state level. The federal Superfund program established a trust fund to pay for the cleanup of abandoned sites while the EPA sought the responsible parties. Likewise, many state cleanup programs mimicked the federal Superfund program and established state trust funds. Generally the state or federal environmental agencies have identified the parties responsible for the pollution, and required such parties to reimburse the fund, or conduct the cleanup if it has not already occurred. This has facilitated extensive litigation between industry and the environmental agencies. One area of contention that has often spurred legal action is the ability of small business owners to pay for cleanups. Some small business owners may have released pollution prior to the implementation of waste management regulations. These owners, however, may be unable to afford the cost of cleaning up the contamination.

The drycleaner industry, comprised largely of small business owners, serves as an interesting example of this debate. Robert Gottlieb characterizes dry cleaning as the "symbol and substance of the small business dilemma for contemporary environmental policy," and observes that small business owners often face conflicting pressures from their suppliers, policymakers and the public. He writes that small businesses encounter environmental problems that may be "more reflective of their dependence upon manufacturers and suppliers in providing products and shaping their processes," while simultaneously remaining "concerned with the public or community perceptions" of the services that they provide.[1]

Drycleaner operations typically generate small quantities of hazardous waste on a routine basis. Prior to the implementation of hazardous waste regulations, drycleaners often disposed of the waste in dumpsters or discharged hazardous wastewater into the sanitary sewer system via storm drains. Consequently, soil and groundwater at many drycleaner facilities necessitates cleanup. Drycleaners have expressed concern about the strict and broad liability requirements imposed under state cleanup programs. Several drycleaner trade associations have responded to concerns for drycleaner liability by working with state legislatures to draft state trust funds that provide resources to remediate drycleaner sites.

This paper provides background information about drycleaner remediation programs, and an overview of three state programs: Kansas, Oregon and Wisconsin. The individual state program overviews explain the statutory requirements, funding structures, application process, cleanup standards, lists the technologies applied, and summarizes compliance information. Each program seeks to achieve a similar goal: remediation of drycleaner sites and prevention of future contamination from drycleaners. The regulatory structure and program administration differ significantly among these programs. The fact that the Kansas, Oregon and Wisconsin environmental agencies are at different stages in terms of program implementation renders comparisons between program accomplishments difficult. However, an analysis of both the individual program components and drycleaner site profiles reveals the strengths and weaknesses of drycleaner remediation programs. The strengths of the three programs include the establishment of a funding mechanism for sites that may not have otherwise been addressed in a timely manner, strengthening waste management practices and reducing the potential for PCE

releases to the environment, the implementation of mandatory pollution prevention practices, outreach efforts to provide technical assistance to drycleaners, and the initiation of a working relationship between the drycleaners and environmental agencies. Analysis reveals several common weaknesses, though they exist to varying extents. Weaknesses include minimal enforcement activities to ensure compliance with waste minimization requirements, and resource and budget constraints. Resource and budget constraints pose challenges to all three states as remediation professionals seek to achieve meaningful cleanup goals on a timely basis.

BACKGROUND

The early twentieth century marked the establishment of commercial dry cleaning. Drycleaners initially used petroleum products as cleaning solvents. These materials posed significant fire hazards, and most of these centralized, industrial facilities were located outside residential areas. The nature and setting of drycleaner operations changed, though, as the demand for drycleaner services increased and alternative cleaning agents became available. Chemical cleaning solvents began to replace petroleum-based solvents, and small, independently owned drycleaners began to appear within the mixed residential and commercially zoned areas during the 1940s. Drycleaners began to rely predominantly on the chemical solvent perchloroethylene, or PCE, as an effective cleaning agent. High PCE prices encouraged drycleaners to recapture the solvent for reuse primarily through transfer units.[2]

The enactment of worker safety and environmental legislation in the 1960s and 1970s triggered investigation of the hazards posed by drycleaner operations. Drycleaner operations became subject to air emission standards by the 1990s under the Clean Air Act, while the Resource Conservation and Recovery Act (RCRA) obligated drycleaners to manage PCE wastestreams as hazardous waste in the 1980s.

Prevalent drycleaner site contamination also launched concerns about classification of drycleaner sites as Superfund sites. Drycleaners were concerned about potentially high cleanup costs that could cause them to go bankrupt. A State Coalition for the Remediation of Drycleaners (SCRD) report currently estimates that of the approximately 22,300 active drycleaner facilities in the nation, 75%, or 17,000, contain "some level of contamination."[3] Although not all contamination necessarily warrants remediation activity, this statistic illustrates the frequency of contamination at these sites. David Anderson, a hydrogeologist at the Oregon Department of Environmental Quality (DEQ), observes that this contamination generally results from the following practices:

- Disposal of PCE-contaminated wastestreams into the sanitary sewer. PCE often leaked through the joints and cracks of the pipes into the soil, and then migrated to the groundwater. Small quantities of PCE were also frequently spilled on the floor when transferring clothing between washing and drying machines. The solvent then often leaked through floor or storm drains into the sanitary sewer system.

- "Backdoor disposal" Disposal of PCE-containing filters and other waste in the area behind the drycleaner facility. PCE often leaked through cracks in asphalt parking lots, or through grass and into the soil.

- Catastrophic releases at the facility during operations, solvent delivery, or in storage areas.

The case studies provided at the end of this report support these three mechanisms as common sources of release and contamination.

Drycleaner trade associations began to develop and push legislation in Washington to reduce drycleaners' liability under Superfund. Although these bills have not passed through the U.S. Congress, drycleaner associations have been successful in influencing state legislatures to pass laws limiting drycleaner liability. In fact, the drycleaner trade associations have often played a significant role in drafting the drycleaner legislation. The state drycleaner laws have mandated dry cleaner registration fees, PCE solvent taxes, and/or gross receipts taxes to establish a trust fund to pay for cleanups.[4]

STATE PROGRAMS

KANSAS

KANSAS: OVERVIEW

The Kansas state Drycleaner Environmental Response Act (DERA) became effective on January 3, 1997, and established the Drycleaning Facility Release Trust Fund. The trust fund provides financial assistance to the owners or operators of drycleaner operations to remediate the site contamination. The Kansas Department of Health and Environment (KDHE) uses the funding to "conduct assessments and corrective actions at drycleaning facilities, or reimburse drycleaning operators or owners for past expenses related to corrective actions at drycleaning facilities."[5] Overall, DERA mandates all operating drycleaning facilities to register with KDHE's Drycleaning Facility Release Trust Fund Program on a yearly basis, establishes performance standards for active drycleaner operations, removes drycleaning wastes from closed facilities, establishes the application process for the owners of contaminated sites seeking funding, the deductible payments, the prioritization of fund expenditures, and how to determine the completion of corrective action activities (Kansas Administrative Regulations [KAR] 28-68).

KANSAS: STATUTORY REQUIREMENTS

The performance standards direct facilities to properly manage all drycleaning waste in order to reduce the impacts of the waste on the environment, and to install secondary containment within the facility to prevent releases of drycleaning waste to the environment. The performance standards are more stringent than federal hazardous waste regulations in that facilities may not discharge drycleaning solvents or drycleaning wastewater, "either directly or indirectly, into any sanitary sewer, storm sewer, or septic tank" (KAR 28-68-3(b)(1)).[6] Finally, the performance standards also mandate drycleaners to use direct-coupled delivery systems to receive chlorinated drycleaning solvents.

KANSAS: APPLICATION PROCESS

Facilities must submit an application to KDHE in order to request technical and financial assistance from the drycleaner program. Facilities must fulfill several eligibility requirements in

order to be accepted to the program. The requirements include payment fees, no gross negligence at the site, compliance with laws, and verification of site contamination (KS Stats 65-34, 148(g)(2)(a)). Drycleaners that have been accepted into the program must pay a deductible of $5,000.00 for each drycleaner facility that has contributed to the contamination of a site (KAR 28-68-6). After KDHE accepts the site into the program, KDHE staff assess the risk the poses to human health and environment in order to assign a priority ranking. KDHE then provides funding to the sites based on the priority ranking. KDHE project managers identify assessment and remediation objectives for the site, and then oversee an environmental consultant who implements the remediation. KDHE relies on a primary consultant to conduct cleanup activities at all of the drycleaner sites.[7] Bob Jurgens, KDHE Drycleaner Program Unit Chief, explained that this minimizes their costs and improves cleanup efficiency.

KANSAS: TRUST FUND

The KS drycleaner trust fund currently has approximately $1.4 million, and obtains this funding from approximately 195 drycleaner facilities.[8] KDHE obtains resources for the trust fund from three methods established under DERA: an annual drycleaner registration fee, a 2.5% gross receipts drycleaner fee, and a solvent fee. The registration fee comprises a small part of the trust fund; facilities each pay $100 annually (KAR 28-68-2(c)). Solvent fees levy an additional cost of $5.00 per gallon of PCE, and $0.50 per gallon of non-chlorinated solvents. The gross receipts drycleaner fee comprised 75% of the drycleaning receipts for fiscal year 2001, solvent fees accounted for 15%, interest 9%, and the registration fee comprised 1%.[9]

KANSAS: FUNDING PRIORITIZATION

The regulations also establish a limit on the amount of funding that can be applied to each site. KAR 28-68-7(a)(3) stipulates that reimbursement for remedial actions that began after July 1, 1995, may not exceed 10% of the fund's income for the previous year. The regulations also instruct KDHE how to prioritize the fund expenditures. Contaminated sites requiring emergency action receive highest priority. Emergency status applies to sites at which contaminants affect public drinking water supply wells, sites at which surface drinking water or a water supply intake is contaminated above acceptable limits and no alternative water supply is available, or when a "high probability exists for direct human exposure to or contact with highly contaminated waste, soil, air or water" (KAR 28-68-8(a)).

KDHE prioritizes funding for remaining sites according to KDHE Contaminated Sites Ranking System (CSRS). CSRS applies uniform technical criteria to assess the potential hazards posed by one site relative to another site. KDHE uses CSRS to assign a "score" for each exposure pathway, including soil/bedrock, groundwater, surface water and air. DERA regulations do not specify certain technologies to be applied at the sites, but rather direct KDHE to give preference to the most cost effective remedies that "adequately" protect human health and the environment (KAR 28-68-8(c)). The cost effectiveness must account for both short and long-term costs. Higher costs must also "reasonably relate to the incremental risk reduction benefits of the corrective action" (28-68-8(c)(2)).

KANSAS: CLEANUP STANDARDS

The DERA regulations do not mandate specific cleanup levels, but direct KDHE to determine those levels. DERA regulations suggest that state and federal drinking water standards as appropriate methods to establish concentration levels that protect human health and the environment. KDHE may approve concentrations that are lower than federal or state drinking water standards based on "an evaluation or risk; the effectiveness of available technology; and the cost of implementation" (28-68-9(c)).

Bob Jurgens explains that Kansas relies heavily on groundwater as a drinking water source. Therefore, KDHE often applies the stringent federal Safe Drinking Water Act Maximum Contaminant Level (MCL) as cleanup goals. KDHE project managers derive soil cleanup goals from the KDHE Bureau of Environmental Remediation's (BER) Risk-Based Standards for Kansas (RSK Manual). The RSK Manual summarizes a three-tiered approach to establish cleanup levels that protect human health and the environment. Tier 1 provides KDHE-approved methods to determine background concentration, Tier 2 offers the KDHE/BER Risk-Based Summary Table, and Tier 3 offers property-specific risk-based analysis using KDHE-approved property-specific information and KDHE-approved methodologies, formulas and models. The RSK Manual identifies the primary cleanup goal for soil contamination as "insuring that sites are remediated to the extent that the public are protected from unreasonable risks caused by sites," and containing contaminant plumes "to the extent that widespread environmental damage is not allowed to occur even though no receptors are effected."[10] Soil cleanup levels are based on whether the contaminant is a carcinogen or non-carcinogen. If soil contamination exceeds a cancer risk of one in 1,000,000, then a concentration corresponding to a one in 100,000 cancer risk may be used as the cleanup level. Site-specific soil cleanup levels may be based on the ability of the "impacted soil to support vegetation representative of unimpacted properties in the vicinity of the site and the potential of the contaminant to impact and degrade groundwater, surface water, or both, through infiltration or runoff."[11]

KANSAS: PROGRAM STATUS

The KDHE drycleaner program has assessed 62 sites, ranked them, and established cleanup priorities. KDHE expects to conduct cleanup activities at approximately half of these sites through the drycleaner program.[12] Bob Jurgens indicates that KDHE seeks to apply at least one innovative technology to a cleanup each year. Jurgens reports that traditional cleanup technologies, such as air sparging, soil vacuum extraction, and pump and treat, have demonstrated better results than innovative technologies, though.[13] Jurgens notes that concentrations have rebounded at sites where innovative technologies were used. The case studies included in this report document cleanup activities at 8 Kansas drycleaner sites. The case studies suggest results that are representative of Jurgens' observation: the traditional technologies have achieved better results to date.

KANSAS: CASE STUDIES

The case studies describe sites that all contain chlorinated solvent contamination, primarily PCE. The contamination at the sites generally resulted from disposal of solvent wastestreams into the sanitary sewer system. Budget constraints exert a significant influence in technology selection at a site. KDHE generally considers trade-offs between the cost of the technology and the time required to complete the remediation. For instance, soil vapor

extraction has proven to be cost effective and shows favorable results, but often requires a longer period of time to remediate the site. Project managers generally require quarterly sampling events at simple sites, or monthly sampling events at more complex sites, following completion of remediation to ensure that concentrations do not rebound. KDHE has not established a standard length of subsequent monitoring, but evaluates the site-specific conditions, like groundwater plume behavior, and concentration trends prior to ceasing corrective action activity.

Four of the cases profiled used air sparging and seven used soil vapor extraction. One site used an in-well stripping system known as KV-Associates C-Sparger System, while another site has used sodium permanganate injections. The site using sodium permanganate injections, "Quick-N-Easy," has not yet achieved favorable results, according to Bob Jurgens. Contractors have been unable to remove the source of PCE at the Quick-N-Easy site. Therefore, once the injections of sodium permanganate, known as Liquox, have completely reacted with the chlorinated VOCs, and are no longer present in the water, the source releases additional PCE. Although Liqoux does effectively destroy PCE, the volume of Liquox has been insufficient to address the continual supply of PCE. KDHE has not yet determine whether it will be possible to inject sufficient quantities to remediate the site. Again, budget constraints will play a major role in deciding what the next steps will be at this site.

KANSAS: COMPLIANCE AND ENFORCEMENT

Finally, KDHE has conducted drycleaning facility inspections to assess environmental compliance rates. KDHE observed a notable increase in compliance rates between 2000 and 2001. Compliance rates increased from approximately 20-25% compliant facilities to 75% compliant facilities. KDHE attributes the dramatic change to the state's enhanced outreach and technical assistance efforts. The efforts include the distribution of a newsletter, discussions with drycleaner trade associations, and collaboration with the KS Small Business Environmental Assistance Program.[14]

OREGON

OREGON: OVERVIEW

The Oregon Legislature passed the Cleanup of Contamination Resulting from Dry Cleaning Facilities statute in 1995 (Oregon Revised Statutes [ORS] 465.500). The OR Legislature promulgated waste management and minimization requirements to prevent future contamination, and established a trust fund to cleanup contamination at active drycleaner sites, or abandoned sites linked to active sites with compliant owners. The law obligated drycleaners to pay fees that established a trust fund to cleanup contaminated drycleaner sites, but also granted drycleaners liability relief from cleanups and cleanup costs. Ultimately the law creates an "insurance pool" that funds cleanup costs for drycleaners. The law establishes conditions that remove liability for individual drycleaners to pay for remediation of site contamination due to past practices.[15]

OREGON: STATUTORY REQUIREMENTS

The OR drycleaner law commits the dry cleaning industry to become a zero release industry. Drycleaners must immediately report to the OR Department of Environmental Quality (DEQ) releases of solvents that exceed one pound (ORS 465.505(4)). Drycleaners must also

submit to DEQ and the OR Department of Internal Revenue an annual report that documents current facility information, type and quantity of solvents used, spills reported, type of dry cleaning equipment, hazardous waste management details, and success in achieving the waste minimization requirements (ORS 465.505(3)). The waste minimization and waste management component of the law mandates equipment and hazardous waste management requirements that prevent solvents from being released to the environment. The performance standards obligate drycleaners to use dry-to-dry machines with refrigerated condensers for PCE, manage all wastes containing PCE, except for wastewater, as hazardous waste, to install secondary containment around all equipment using solvents, rely on closed, direct-coupled delivery systems for PCE deliveries, and prohibit the disposal of wastewater generated from dry cleaning machines into sanitary sewer system, septic system, or waters of the state (ORS 465.505(1-3)).

OREGON: TRUST FUND

The OR drycleaner law stipulates that OR drycleaners would fund the trust fund, and generate $1 million annually. The $1 million goal has not been reached in any year of the program since drycleaners began to pay fees in January 1996. The annual revenue has reached an average level of $750,000.[16] Drycleaners pay both an annual facility fee of $1000 and a per gallon use fee for solvents. Facilities that do not operate dry cleaning equipment, but sell at least $50,000 of dry cleaning services annually, pay $500 facility fee instead of the $1000 facility fee. OR state levied solvent fees of $12.00 per gallon of PCE and $2.40 per gallon for other solvents in 1996. The drycleaner law mandated an increase of 3% for solvent fees each year. The fees for each year are expected to generate $1 million. The solvent fee was also increased by $4 on October 1, 1998, because $1 million had not been generated in the previous 12-month period. Currently the PCE solvent fees are $26.67 per gallon, and the non-PCE solvent fees are approximately $5.25 per gallon. The fees will increase to $30.27 per gallon of PCE and $6.05 per gallon non-PCE in October 2001, but will sharply decrease to $10.00 per gallon PCE and $2.00 per gallon PCE in January 2002.[17] These figures do not include the retail cost of the solvents, but represent the additional surcharge imposed by the drycleaner law. OR DEQ estimates between 1995 and 2000, solvent fees have more than quadrupled the price for PCE.[18] The fee structure will radically change in January 2002. The solvent fees and facility registration fee will decrease, and drycleaners will also pay a risk-based fee, that accounts for the level of PCE usage, a gross revenue fee, and a fee for inactive sites.[19]

OREGON: APPLICATION PROCESS

Facilities must submit an application to the OR DEQ in order to request technical and financial assistance from the drycleaner program. The drycleaner law specifies in ORS 465.503(3) that drycleaners will be exempt from liability provided that:

- The release did not result from gross negligence of the drycleaner owner or operator
- The release did not "result from a violation of federal or state laws in effect at the time of the release, including but not limited to waste minimization requirements imposed under ORS 465.505"
- Drycleaner owner or operator has not intentionally failed to report solvent spills
- Drycleaner denied access or unreasonably hindered or obstructed removal or remedial action at the facility
- Drycleaner has paid fees levied by the drycleaner law.

OR DEQ generally accepts facilities that fulfill these criteria and submit the proper paperwork. Facilities that have abandoned do not qualify for the program unless they are linked to active facilities with compliant owners. Drycleaners that have been accepted into the program and have 5 or fewer full and part-time employees must pay a deductible of $5,000.00 for each drycleaner facility, while drycleaners with greater than 5 employees must pay a deductible fee $10,000.00 (ORS 465.510(6)). The statute does not limit the amount of money that can be spent on each site. The statute does, however, provide guidelines to DEQ regarding funding prioritization.

OREGON: FUNDING PRIORITIZATION

ORS 465.510 establishes guidelines for allocating money among the sites, and determining the order in which removals and remedial actions occur. DEQ must evaluate the risk the site poses to public health and environment, relative to the risk posed by other facilities, the need for a removal or remedial action at the drycleaner facility relative to account availability and the need for removal or remedial actions at other facilities, and the nature of the activities for which expenditures are necessary (ORS 465.510(3)). ORS 465.510(3)(c) ranks necessary expenditures as follows, beginning with the highest preference:

(A) Direct cost of cleanup, provided that adequate technical investigation has been completed;
(B) Direct cost of technical investigation and remedy evaluation;
(C) Administrative and indirect costs; and
(D) Enforcement, cost recovery and legal costs.

OR DEQ then provides funding to the sites based on these criteria. DEQ project managers identify assessment and remediation objectives for the site, and then oversee an environmental consultant who implements the remediation. Drycleaner owners retain the option to hire their own cleanup contractor, and then receive reimbursement from DEQ for the contractors. Most drycleaners avoid the reimbursement process and allow DEQ contractors to conduct remedial activities.

OREGON: CLEANUP STANDARDS

The OR drycleaner law does not mandate specific cleanup levels or guidelines for establishing site-specific cleanup levels. Oregon relies on DEQ risk assessment policies and guidance to establish site-specific cleanup goals. Project managers use the draft Risk-Based Decision Making for the Remediation of Chlorinated Solvent Sites document, dated October 2, 2000, to establish the appropriate levels at the drycleaner sites. (DEQ expects to finalize the document in late 2001). The risk-based decision making process requires project managers to evaluate "current and reasonably likely future risks to human health and the environment associated with contamination at a site" and then to use that information to "develop the best combination of cleanup and site management to reduce those risks to acceptable levels."[20] Project managers assess the risk, which is defined as the product of a chemical's toxicity and the degree of exposure to the chemical, by considering the nature and magnitude of the release, the extent of contamination, the toxicity of the contaminant, and the exposure routes. Once the project manager has identified the risk level for a drycleaner site, he/she can compare that level to the acceptable risk levels defined by Oregon Administrative Regulations (OAR) 340-122-115. The acceptable risk level of human exposure to carcinogens is defined as a lifetime "excess

cancer risk of less than or equal to one per million for an individual at an upper-bound exposure," while the acceptable risk level for cumulative exposure to multiple carcinogens is "cumulative lifetime excess cancer risk of less than or equal to one per one hundred thousand at an upper-bound exposure." Finally, the acceptable risk level for non-carcinogens is defined as a "hazard index of less or equal to one for an individual at an upper-bound exposure."[21]

This process is used to determine cleanup goals for both soil, groundwater, and indoor air. David Anderson, DEQ Hydrogeologist, has indicated that frequently it is not necessary to reduce contaminant levels to the federal Safe Drinking Water Act MCLs because the groundwater is not used for beneficial uses, like drinking water.[22] Dick DeZeeuw, the OR DEQ Drycleaner Program Coordinator, has indicated that "indoor air quality is becoming more relevant as a pathway of concern at dry cleaning sites in Oregon." Project managers have found that source of indoor air concerns stems from subsurface contamination at active facilities, rather than from the dry cleaning machines.[23]

OREGON: PROGRAM STATUS

The OR DEQ drycleaner program has accepted cleanup applications from 27 dry cleaners and completed cleanups at 7 sites. Budget constraints have forced DEQ to put 10 sites on hold. DEQ is currently conducting assessment activities at six sites and implementing remediation at four sites.[24]

OREGON: CASE STUDIES

The case studies included in this report document investigation and cleanup activities at six Oregon drycleaner sites. The case studies describe sites that primarily contain chlorinated solvent contamination, notably PCE. The contamination at the sites generally resulted from disposal of solvent wastestreams into the sanitary sewer system or backdoor disposal. Budget constraints exert a significant influence in technology selection at a site. The case studies reveal that DEQ has implemented primarily traditional technologies. One site involved a soil removal action, three sites involved soil vapor extraction, one involved air sparging, and two involved groundwater pump and treat operations. One site profile, the Springdale site, documents the use of an innovative technology known as Hydrogen Release Compound (HRC). The project manger, Kevin Parrett, views HRC as a promising, cost-effective approach for residual dense, non-aqueous phase liquid (DNAPL) contamination. The PCE concentrations decreased significantly within six months of HRC injection. HRC can be more cost effective and feasible than soil vapor extraction or excavation when access is limited at sites. For example, building structures may impede access to the contaminated groundwater. Accumulation of toxic PCE breakdown products, such as vinyl chloride, does not appear to be a problem at the Springdale site. Sampling and monitoring reports suggest that these daughter products are continuing to degrade into harmless products. PCE concentrations have not rebounded during the 1.5 years of the treatment study. Parrett indicates that it is unclear how much more time will be necessary before cleanup goals are achieved.

OR DEQ estimates that typical dry cleaning site cleanup costs range from $100,000 to over $400,000. Sites that involve drinking water contamination will be much more expensive, and costs can reach up to $1 or $2 million.[25] OR DEQ also indicates that the drycleaner sites require approximately one to two years to complete assessment and cleanup activities. The OR

sites profiled in this report include both straight-forward sites requiring only a site assessment or soil removal, and complex sites necessitating extensive assessment and cleanup activities. Project managers generally require quarterly sampling following completion of remediation to determine if concentrations rebound. OR DEQ has not established a standard length of subsequent monitoring, but evaluates the site-specific conditions, like groundwater plume behavior, and concentration trends prior to ceasing corrective action activity.

OREGON: COMPLIANCE AND ENFORCEMENT

DEQ staff report that budget constraints impose significant limitations to the OR drycleaner program, and few resources exist for enforcement activities. OR DEQ conducted technical assistance visits at drycleaner facilities in summer 1999. The visits revealed high compliance with the waste minimization requirements. In fact, DEQ documented a 100% compliance rate with the dry-to-dry equipment requirement, a 99% compliance rate with the requirement to install refrigerated condensers on all of the PCE machines and the prohibition for disposal of waste into the sanitary sewer, 97% compliance rate for secondary containment requirements, 98% compliance rate for proper hazardous waste management, and 94% compliance rate with PCE solvent delivery through a direct-coupled delivery system.[26] The DEQ drycleaner program has not initiated investigations to assess whether contamination at certain facilities resulted from gross negligence. Dick DeZeeuw indicated that, given the drycleaner program's budget constraints, scare resources are more effectively directed at the actual remediation activity.

WISCONSIN

WISCONSIN: OVERVIEW

The Wisconsin Legislature signed Wisconsin Act 27 into law on October 27, 1999 (Wis. Stats. Ch. 292.65-66). The Act created the Wisconsin Drycleaner Environmental Response Program (DERP), a funding program that reimburses drycleaners for a portion of their costs associated with responding to, investigating and remediating contamination caused by releases of dry cleaning solvents. Drycleaners pay fees which supply the reimbursement fund. The Act also directs drycleaners to implement several pollution prevention methods.

WISCONSIN: STATUTORY REQUIREMENTS

The pollution prevention requirements of the Act relate to solvent delivery, equipment standards and hazardous waste management practices. Drycleaner facilities constructed on or before October 14, 1997, which experience a new release 91 days or later from receiving case closure from the DNR for a past cleanup, and new facilities constructed after October 14, 1997, are required to implement the following pollution prevention practices:

- Manage all dry cleaning wastes containing solvent as hazardous waste;
- Prohibited from discharging dry cleaning solvent or wastewater from dry cleaning machines into the sanitary sewer, storm sewers, septic tanks or into waters of WI;
- Install secondary containment around equipment that uses dry cleaning solvent;
- Seal or otherwise render the floor impervious to dry cleaning solvent;
- Ensure delivery of dry cleaning solvent through a closed, direct-coupled delivery system (Wis Stats 292.65(5)(b)).[27]

The statute does not contain language that explicitly prohibits facilities who have demonstrated gross negligence with respect to waste management from qualifying for reimbursement (Wis Stats 292.65-66).

The DNR, Wisconsin Fabricare Institute, University of Wisconsin – Extension, the Department of Commerce, and the Center for Neighborhood Technology have also implemented Wisconsin's Five Star Program as part of the Pollution Prevention Partnership. The Five Star program ranks participating dry cleaners on a scale of one to five stars as a way to alert customers to the extent of drycleaners' pollution prevention practices. The star rating system also identifies drycleaners who have gone above and beyond the statutory pollution prevention requirements.[28]

WISCONSIN: REIMBURSEMENT FUND

The drycleaner act also directs drycleaners to pay several fees that supply the reimbursement fund. Drycleaners initially paid a one-time fee in 1998 based on the solvents that they possessed on October 14, 1997. Drycleaners currently pay an annual license fee of 1.8% of their gross receipts for dry cleaning services. Solvent suppliers also pay a quarterly fee for the solvents that they sell: $5.00 per gallon for PCE and $0.75 per gallon for hydrocarbon based solvents.[29] The reimbursement fund grew to approximately $1,680,200 between the initiation of fee collections in February 1998 and June 30, 1999. The one-time solvent fee paid by drycleaners accounted for $123,200.00, license fees contributed $1,180,600.00, solvent fees totaled $329,000.00 and interest contributed $47,400.00. A total of 320 dry cleaners provide license fees for approximately 350 sites, and 13 suppliers contribute solvent fees. DNR collects approximately $1 million annually. DNR estimates that license fees comprise approximately 80% of the $1 million and solvent fees comprise approximately 20% of the total. DNR also expects to target over 80% of the fund for reimbursements, and to apply less than 20% to staff and administrative costs, and technical reviews.[30] The most recent estimate of the reimbursement fund balance reveals that a total of $3.5 million has accumulated over a time period of four years.[31]

DERP reimburses three different types of response action costs at drycleaner sites: immediate action costs, interim action costs and remedial actions costs (including site investigations). Immediate action refers to a "response action taken within a short period of time after the discharge of a hazardous substance occurs, or after the discovery of a hazardous substance discharge or environmental pollution." The immediate action is intended to remove any imminent threats posed to public health, safety or welfare.[32] DNR defines interim actions as those that are taken "to contain or stabilize a discharge of a hazardous substance, in order to minimize any threats to public health, safety or welfare or the environment, while other response actions are being taken or planned for the site or facility." Interim actions are further divided into two categories: 1) preliminary site screening and 2) the purchase and installation of interim action equipment. Drycleaners may be reimbursed for only a maximum of 50% of the interim action costs, and the total reimbursement amount may not exceed $20,000.00. The award period for interim actions ends on June 30, 2002.[33] Finally, remedial action refers to a "response action, other than immediate or interim action, taken to control, minimize, restore or eliminate the discharge of hazardous substances or environmental pollution so that the hazardous substance or

environmental pollution does not present an actual or potential threat to public health, safety or welfare or the environment."[34]

WISCONSIN: REIMBURSEMENT ELIGIBILITY

Owners and operators of dry cleaning facilities, and their agents, are eligible for reimbursement, and may submit applications to DNR once they have completed a site investigation, selected a remedy and established a schedule to implement the remedy. The owners of sites which formerly housed drycleaners are not eligible to receive program funding unless the facility possessed a dry cleaner license issued by Wisconsin state. Drycleaners must comply with the WI spill response laws in order to qualify for reimbursement. The spill response laws obligate the drycleaner to provide immediate notification of the discharge of hazardous substances to the environment. Dry cleaners seeking reimbursement for response action costs must pay a deductible. Facilities must pay a $10,000 deductible for immediate and remedial action costs less than or equal to $200,000.00. Immediate and remedial action costs between $200,000 and $400,000 correspond to a deductible of $10,000 plus 8% of the amount less than $200,000. Finally, immediate and remedial action response costs that exceed $400,000 correspond to a deductible payment of $26,000 plus 10% of the amount greater than $400,000. There is no deductible fee for interim action costs given that interim actions are a 50% co-pay. The drycleaners may receive up to $500,000 for immediate and remedial action costs, and up to a maximum of $20,000 for interim action costs.[35]

WISCONSIN: FUNDING PRIORITIZATION

The drycleaner statute provides explicit guidance regarding allocation of the reimbursement fund (Wis Stats 292.65(3)(a)(3)). The law places the highest priority on reimbursing immediate action costs. DNR must reserve, on an annual basis, 9.7% for immediate actions. The next priority for reimbursements is past costs. The statute required DNR to reserve, in the first year, 75% of the fund for eligible costs incurred between January 1, 1991 and October 14, 1997. The percentage set aside decreases in subsequent years: DNR must reserve in the second year 50% for past costs, and 30% the third year and every year thereafter until all past costs have been reimbursed. DNR must then reserve 46% of the remaining funds on an annual basis for interim action reimbursements. Interim action funds are divided into three risk categories: high, medium and low. Sixty percent of the interim action money must target the high risk category, 25% must target the middle risk category and 15% must target the low risk category. Finally, remaining funds may be applied to site investigations and remedial action reimbursements. This category is designed in a similar manner as the interim action category, with 60% applied to high risk sites, 25% applied to medium risk sites, and 15% applied to low risk sites.[36]

Unlike the Kansas and Oregon drycleaner programs, the Wisconsin program does not provide cleanup contractors, but rather requires the drycleaner to hire contractors. The drycleaner must use the qualification based selection system, which includes at least three competitive proposals for interim action, site investigation, and the selection of remedial action activities. Drycleaners must provide justification to DNR if they do not choose the lowest cost proposal.[37]

WISCONSIN: CLEANUP STANDARDS

DERP requires drycleaners to comply with the Wisconsin state cleanup requirements in order to qualify for reimbursement. The Wisconsin cleanup regulations establish guidelines for facilities to notify DNR of the releases of hazardous substances to the environment, to conduct the immediate, interim and remedial response actions, lists guidelines to identify qualified cleanup contractors, provides standards for selecting remedial actions, documents soil cleanup standards, and summarizes case closure and enforcement information (Chapter NR 700 Rule Series).

The regulations establish some numeric cleanup levels applicable to the drycleaner site cleanups. The regulations establish two tiers of numeric groundwater quality standards: a preventive action limit (PAL) and an enforcement standard (ES) (Ch. NR 140). The PAL is often used as a screening level, and the more stringent ES levels are generally used to determine whether closure is appropriate. The ES for PCE is 5 ppb.[38] A majority of the groundwater standards are the same as the federal Safe Drinking Water Act MCLs.[39] Chapter NR 720 provides guidelines for determining site-specific residual cleanup levels for soil as well as general soil standards. Although NR 720 provides numeric soil cleanup levels for some contaminants, it does not include a standard for PCE.[40] Facilities derive the site-specific levels by evaluating the exposure or migration pathway of concern at a site. Facilities must base the soil cleanup standard on the "lowest concentration of all individual residual contaminant levels determined for each pathway" (Ch. NR 720.07(b)). WI DNR identifies the following potential soil pathways: groundwater, direct contact, pathway to surface waters, pathway to sensitive environments, and plant uptake and food chain. The residual contaminant soil levels are calculated in the same manner as the general soil levels, but they factor in more site-specific information. The additional information may include consideration of land use and the specific soil and groundwater conditions at the site.[41]

WISCONSIN: PROGRAM STATUS

The DNR has received a total of 17 applications for reimbursement of past and current costs thus far. In addition, DNR has received notification that 24 claims will be submitted once facilities fulfill the application requirements.[42] Robin Schmidt, Hydrogeologist Program Coordinator at DNR, explains that DNR has encountered difficulties with sites being eligible for reimbursement. Technically, only the drycleaner owner or operator may receive reimbursement. People who purchase sites that were contaminated by former drycleaners do not qualify for reimbursement. These individuals must identify the original drycleaner and convince him/her to sign an agreement and submit a joint application.[43] WI DNR seeks to make changes to the statute to streamline the program.

WISCONSIN: CASE STUDIES

The case studies describe sites that contain chlorinated solvent contamination, primarily PCE, and a few sites that contain Stoddard solvent contamination. The contamination at the sites generally resulted from disposal of solvent wastestreams into the sanitary sewer system or disposal of waste materials behind the facility. Generally the drycleaners should select the lowest cost remediation to cleanup the site in order to qualify for reimbursement. Facilities may select more expensive options, but need to justify the extra expense to DNR to receive reimbursement. Robin Schmidt has explained that the WI drycleaners consider tradeoffs

between relatively inexpensive and expensive technologies: higher price technologies may remediate a site more quickly and prevent the contaminant plume from migrating. However, drycleaners may not receive all of the costs back from the reimbursement fund. The fund currently provides approximately $1 million each year, but DNR expects larger sites to drain the fund quickly.[44]

The case studies reveal that drycleaners have implemented both traditional and innovative technologies at the site. Four sites involved a soil removal action, three sites involved soil vapor extraction, two involved air sparging, two involved groundwater pump and treat operations, one involved soil containment (capping in place), and four involved natural attenuation. Non-traditional technologies applied at the sites include Hydrogen Release Compound (HRC) injections, molasses injections (carbon amendment), mobile injection treatment units (thermal treatment), and hydrogen peroxide injections.

Quarterly sampling events generally are conducted at the sites following completion of remediation to ensure that concentrations do not rebound. The DERP program does not establish a standard length of subsequent monitoring, given that it is a reimbursement fund only. However, drycleaners generally confer with DNR project managers in order to relay site-specific information and to discuss what goals should be demonstrated in order to close the site or to receive a no further action letter. The sites are closed in accordance with the standards provided in the spill response regulations, Ch. NR 720.

WISCONSIN: COMPLIANCE AND ENFORCEMENT

DNR has not conducted enforcement activities under the DERP program. The authority to require the cleanup itself originates in other WI statutes. DERP is intended to provide a reimbursement source for drycleaner remediations. Inspections related to the pollution prevention requirements have not been conducted. DNR staff note that budget constraints impede DNR's ability to prove if certain facilities demonstrated gross negligence. One facility received reimbursement for cleanup costs despite receiving several hazardous waste violations. The circumstances of the hazardous waste violations are unknown.

DISCUSSION

The three programs pursue similar goals: the remediation of drycleaner sites and the prevention of future contamination at these sites. The following section will highlight the major differences and similarities among the three programs, and conclude with a summary of the common strengths and weaknesses.

MORAL HAZARD

Economists use the term "moral hazard" to refer to a distortion of behavior that raises the probability that one will do a 'bad' thing, and make the bad event more likely to occur. Moral hazards result from imperfect information. Insurance policies serve as a common example for a moral hazard. Insurance companies cannot observe whether the insured exerts an effort to prevent loss.[45] The drycleaner programs could be viewed as an insurance policy for drycleaner spills. The states generally lack the resources to determine whether or not facilities take adequate steps to prevent releases of hazardous substances to the environment. Therefore, the

theory of moral hazard suggests that drycleaners contributing money to the fund may not adhere strictly to the pollution prevention requirements, and view the trust fund as a ready source for remediation costs.

The programs reviewed for this analysis mandated similar pollution prevention requirements. Active drycleaners in Kansas, Oregon and Wisconsin must receive solvent deliveries through a direct-coupled delivery system, manage solvent wastes wastewaters as hazardous wastes, install secondary containment around equipment using PCE, and may not discharge solvent wastes into the sanitary sewer system, septic tanks or surface waters. The program literature from all three states indicated that facilities that demonstrate gross negligence will not qualify for funding. Program managers, though, indicated that because proving gross negligence can be a costly, time-consuming task, the agencies rarely, if ever, pursue that task. Generally it is viewed as preferable to devote scare resources to the cleanup itself, rather than determine whether the facility willfully violated the regulations.

This suggests that it would be critical to conduct enforcement activities, such as facility inspections. Kansas conducted the most extensive inspection activities of the three states. Leo Henning, who oversees the KDHE drycleaner program, expressed his confidence that most drycleaner facilities are in compliance with the performance standards and manage hazardous wastes responsibly. The recent inspection results support his observation: compliance rates for the performance standards ranged from 94-99%. Oregon has conducted some technical assistance visits, but Wisconsin has not recorded any inspections or technical assistance visits.

Minimal enforcement activities diminish the amount of compliance information available to the drycleaner programs, and create the potential for a moral hazard. The laws include requirements to prevent the moral hazard, and to require facilities to avoid releasing hazardous substances to the environment. However, if it appears unlikely that the state would learn of non-compliance, or that the state would offer reimbursement despite non-compliance, then there is little incentive for facilities to fully implement the pollution prevention requirements. This discussion is not intended to imply that all drycleaner facilities would fail to implement pollution prevention requirements in the absence of strict enforcement. Rather, this moral hazard discussion suggests that if drycleaners are contributing funds to an insurance policy, the knowledge that he/she would receive remediation funding in the event of a spill may lessen the incentive to carefully manage wastes.

ROLE OF THE DRYCLEANER AND CONTRACTOR

The role of the drycleaner, state agency and contractors varied among the three state programs. The drycleaners appear to play the least active role in Kansas, a varying role in Oregon, and the most active role in Wisconsin. KDHE and OR DEQ retain the greatest amount of oversight in the drycleaner remediation process. WI DNR's role is the most limited, given that the WI drycleaner program is a reimbursement program. While the KDHE and OR DEQ specify that the state retains oversight authority, the WI DNR drycleaner staff do not technically need to authorize or provide approval to remediation activities. However, the reality is that drycleaners want to receive reimbursement for their activities, and do engage the state during the remediation process. Despite the different state and drycleaner roles in the three states, they are

all ultimately working toward the same goal: cleaning up the site in a cost effective and timely manner.

The contractors may not have the same incentive to ensure cleanup in a cost effective or short time frame. KDHE seeks to avoid problems with expensive or protracted contractor work by securing one firm to conduct all remediation activities. KDHE awards a contract to one firm, and the contract lasts for three years. This appears to yield efficiency among the remediation activities at the sites: less time is expended on awarding the contract for each site, and the contractor can focus more attention on the cleanup itself, rather than the proposal process. The potential negative aspect of this, though, is that the state could become too dependent on one firm, and fail to proactively determine whether other contractors might achieve better cleanup results or implement more cost effective technologies. OR DEQ provides drycleaners the option for hiring their own contractor, but most allow DEQ to hire a contractor. OR DEQ does not have the same policy as Kansas, and hires several different contractor for drycleaner remediation activities. Finally, the drycleaners in Wisconsin must select their own contractor according to the terms specified by the regulations. Review of the case studies suggest that a variety of consulting firms conduct the remediation activities. Several contractors appear to have developed a positive professional relationship with some of the WI DNR staff, though. These contractors keep the WI DNR program managers apprised of the cleanup status and seek feedback regarding remediation plans.

Although data is not available to compare the benefits of using one contractor versus multiple contractors, there appear to be substantial benefits incurred with a one-contractor policy. For instance, the guarantee of work projects may lessen the contractors' incentive to exaggerate the necessity for certain projects. A single contractor would also increase consistency among the sites, and make it easier to apply the lessons learned to new sites. In other words, as the contractors encounter difficulties implementing technologies, they would adjust to the problems and apply the "lessons learned" to other sites. A possible advantage associated with multiple contractors, though, would be drawing from multiple resources and expanding expertise applied to a site.

CLEANUP GOALS: NUMERIC LEVELS

The case studies emphasize the significant level of diversity among the cleanups. Site conditions like lithology, site hydrogeology, and location of buildings or other structures, the nature and extent of contamination, and the uses of the soil and groundwater, render comparisons between the sites difficult. Cleanup goals, therefore, will also differ depending on the site circumstances. The three states use slightly different standards with regard to cleanup goals, but they all demonstrated the same point: cleanup goals are constantly evolving during the remediation activity. Project mangers are likely to modify established numeric levels, depending on the concentration trends, the extent to which technologies can remediate the contamination, the amount of funding available, the extent of public exposure to the contaminated resources, and many other factors.

Kansas, Oregon and Wisconsin apply cleanup goals that are based, to different extents, on risk-based standards. As discussed in the Oregon section, the OR DEQ applies risk assessment methods to identify appropriate cleanup levels for both soil and groundwater.

Oregon does not automatically default to the federal Safe Drinking Water Act MCLs. Rather, Oregon incorporates the beneficial use of the groundwater into the risk assessment process. Oregon does not use much groundwater for drinking water. Therefore, the MCLs may not be appropriate for those sites. Kansas and Wisconsin rely significantly on groundwater for drinking water, and therefore tend to default to the stringent federal MCLs more frequently in cleanups. Interviews with project managers and review of the case studies suggest that Oregon faces greater challenges in reducing volatile contaminant concentrations in indoor air, while Kansas and Wisconsin focus more attention on remediating groundwater.

FUNDING

The fee structures vary for each state. Kansas places the greatest emphasis on a gross receipts drycleaner tax. The Kansas program imposes the lowest fees of the three states: a $100 annual registration fee, an annual 2.5% gross receipts tax, and a $5.00 per gallon tax on PCE. Oregon imposes the highest fees of the three states: an annual $1000 facility fee (or $500 for dry facilities), and a $25.00 per gallon tax on PCE. Oregon does not implement a gross receipts tax. Finally, Wisconsin facilities pay an annual license fee that constitutes 1.8% of gross receipts, and a $5.00 per gallon tax on PCE.

Unlike Oregon, the Kansas and Wisconsin programs collect fees based on gross receipts. The Kansas and Wisconsin trust funds each collect more funding than the Oregon trust fund. The Kansas trust fund currently contains $1.4 million and collects the fees from approximately 195 active drycleaners. The Wisconsin reimbursement fund collects approximately $1 million annually from the 360 active facilities, while the Oregon program collects an average of $750,000.00 annually from 90% of the 350 active drycleaners. The Oregon program has not yet reached the goal to collect $1 million annually.

Oregon program staff suspect, but have not confirmed, that drycleaners may avoid the solvent tax by purchasing solvents from out-of-state. Many drycleaners live near the Washington state border, and could readily purchase dry cleaning solvents from Washington suppliers who are not subject to the tax. Oregon has raised the solvent tax rate several times in an attempt to reach the annual goal, but has not succeeded in doing so yet. Consequently, PCE has become expensive in Oregon – drycleaners currently pay $25.00 per gallon in taxes alone.

The gross receipts tax imposed by Kansas and Wisconsin is harder to circumvent. The gross receipts tax appears to be a fair way for drycleaners to contribute to the fund, given that the magnitude is proportional to the level of business that they conduct. Leo Henning (KDHE) indicated that the gross receipt tax has worked well in Kansas. Henning explained that drycleaners pass this tax on to consumers without fearing a significant business reduction because consumers understand the tax is imposed by the government.

The use of cost controls, like price caps, seems to play a critical role in allocating funding among small and large sites. This practice allows the state to distribute money to multiple sites for each fiscal year, and prevents the program from concentrating the funding on complex sites. The Kansas regulations impose an annual price cap of 10% of the fund's income for the previous year, and a total price cap of $5 million for each site (KAR 28-68-7(a)(3)). Wisconsin program stipulates a maximum reimbursement of $500,000.00 for immediate and remedial action costs,

and a maximum reimbursement of $20,000.00 for interim action costs. Oregon does not impose any price caps.

Price caps may pose an advantage not only by equitably allocating funds among multiple sites, but also by minimizing the potential for cleanup delays or wasteful usage of resources. A set amount of funding could provide incentive to remediation contractors to implement efficient and effective technologies. Possible disadvantages of the price cap may include inhibiting the application of innovative technologies or removing incentive to achieve above and beyond cleanup goals. The success of the price cap likely depends on the magnitude of the limit.

The case studies do not reveal whether the presence of price caps impacted the quality or efficiency of the cleanup. Kansas has addressed the greatest number of sites, but it also has the largest trust fund and has operated for five years, the longest time period of all three state programs. Wisconsin has processed the fewest number of applications, but the reimbursement process has been operating for about 1.5 years, and is still in early implementation stages. Although the Oregon program has operated for 4.5 years, budget constraints recently forced the state to reduce the site workload. There does not seem to be evidence that a few sites are absorbing resources at the expense of smaller sites. In fact, Oregon has supplemented the funding of several complex drycleaner sites with money from the state's Voluntary Cleanup Program.

CONCLUSION

The drycleaner remediation programs demonstrate that industry and the government can work together to clean up contamination to meet federal or state standards without bankrupting the small, independently owned businesses. The review of the state drycleaner remediation policies reveals that the strengths of the programs include the establishment of a funding mechanism for sites that may not have otherwise been addressed in a timely manner, strengthening waste management practices and reducing the potential for PCE releases to the environment, the implementation of mandatory pollution prevention practices, outreach efforts to provide technical assistance to drycleaners, and the initiation of a working relationship between the drycleaners and environmental agencies. Analysis reveals several weaknesses that exist to varying extents. One area for concern involves the moral hazard associated with the insurance policy aspect of the programs. The programs fail to provide pollution prevention incentives in the absence of enforcement activities and/or inspections. Finally, resource and budget constraints pose challenges to all three states as remediation officials seek to achieve meaningful cleanup goals on a timely basis.

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