Tradeable Credit Applications to Integrated Waste Management

Analysis of Emerging Market Development Options
Report #4

DRAFT

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NOTE: Legislation (SB 63, Strickland, Chapter 21, Statutes of 2009) signed into law by Gov. Arnold Schwarzenegger eliminated the California Integrated Waste Management Board (CIWMB) and its six-member governing board effective Dec. 31, 2009.

CIWMB programs and oversight responsibilities were retained and reorganized effective Jan. 1, 2010, and merged with the beverage container recycling program previously managed by the California Department of Conservation.

The new entity is known as the Department of Resources Recycling and Recovery (CalRecycle).

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Forward

Tradeable Credit Applications to Integrated Waste Management is one of five reports prepared in connection with the Board's Analysis of Emerging Market Development Options. As outlined in **Meeting the Challenge: A Market Development Plan for California**, the analysis was undertaken to better understand several policy options and issues concerning recycling market development in California.

Four additional Board reports were prepared as part of this project:

Report #1 ***Summary Report on Emerging Market Development Options***, prepared by Board Staff, summarizes the key findings of the entire project.

Report #2 ***Manufacturer Responsibility Options to Support Integrated Waste Management***, prepared by Board Staff, with contractual assistance by Resource Integration Systems, Ltd., and California Futures, Inc.

Report #3 ***Fee System Options to Support Integrated Waste Management***, prepared by Booz-Allen & Hamilton, Inc.

Report #5 ***Emerging Issues: Global Agreements***, prepared by Board Staff.

The reports are available by contacting the Board at (916) 255-2296.

TRADEABLE CREDIT APPLICATIONS TO INTEGRATED WASTE MANAGEMENT

Introduction

Responsible environmental policy means much more than simply protecting the environment. For many it "means making the most of scarce resources and maximizing returns on resources invested - business costs, regulatory effort, political capital, and taxes - to improve the quality of the environment" (Stavins and Whitehead 8). Traditionally, command and control policies[1] have been used to mitigate environmental damage; however, alternative market-based policies, such as tradeable credits, may produce far more efficient allocation of scarce resources than traditional policies.

This paper consists of three major components: 1) an overview of the theory of tradeable credits, 2) case studies of existing tradeable credit programs, and 3) possible applications of tradeable credit programs to integrated waste management. The first section is simply an overview of the mechanics and attributes that contribute to a successful tradeable credit program. The second section reviews programs that have been implemented in the past in an attempt to learn from their failures and successes. The final section attempts to apply tradeable credit programs to existing integrated waste management programs and determine the likelihood of the programs' success based on the dynamics of tradeable credit theory and the lessons learned from the case studies.

Overview of tradeable Credits; A Market Based Policy

A tradeable credit policy assumes that limited amounts of pollution can occur without substantial degradation of the environmentor that agreements can be reached on an "acceptable" level of pollution. Once the level is established, entities then have the right to pollute up to the acceptable level without incurring penalties. A tradeable credit policy requires that the ownership of pollution

[1]Command and control policies differ from market based policies, such as tradeable credits, in that they provide only compliance option, generally the adaptation of specific control technology. On the other hand, market-based policies offer a variety of options to meet compliance.

rights be established so they can be purchased or sold to achieve the most equitable[2] and cost effective distribution of resources. In order to utilize tradeable credits three prerequisites must be fulfilled: 1) a measurable industry goal for pollution reduction must be determined, 2) ownership of pollution rights must be assigned so that responsibility for pollution can be established, and 3) owners of pollution rights must be able to buy and sell excess credits generated by the reduction of pollution below the limit set for each entity that owns pollution rights.

For example, if a tradeable credit program were applied to an integrated waste management objective such as a minimum content requirement, the above prerequisites could be applied by: 1) establishing an industry goal specifying the amount of secondary material that must be used in a specific product, 2) assigning individual entities the responsibility of using a specific amount of secondary materials, versus virgin materials[3], and 3) allowing those entities with the ability to use secondary materials in excess of what they are responsible, to sell the excess to entities unable to increase their use of secondary materials.

Pollution Reduction Goals: The first prerequisite for the implementation of a tradeable credit policy is the establishment of a pollution reduction goal or "a target level of environmental quality" (Hahn 96). Pollution reduction goals under policies utilizing tradeable credits specify an overall reduction goal for an entire industry. Tradeable credits allow the entities within the industry to determine how those goals are achieved.

Pollution reduction goals can be fixed or implemented using a stepped approach. A stepped approach would decrease the amount of allowable pollution incrementally, over several years, achieving the goal by a set date. The stepped approach puts limits on the amount of pollution immediately; however, incentives to utilize creative pollution reduction techniques continue to be present as the ceiling on pollution is lowered.

Ownership of Pollution Rights: A tradeable credit program must assign an entity ownership

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[2]Equitable in that the cost of complying with regulations is more evenly spread under a "properly functioning" tradeable credit program that allows entities to utilize more than one compliance option, than it is under a traditional command and control policy which mandates the use of a particular control technology, regardless of cost.

[3]In the case of minimum content requirements, the right to pollute is synonymous with the right to use virgin materials.

of a common resource. A common resource is distinguished by the fact that everyone has access to it, such as air, water, etc... Individuals or entities using a "common resource do not fully internalize the cost of resource depletion. The result is that a resource is "overused" relative to what might have occurred with individual private ownership or even public ownership" (Hahn and Hester 361). Individuals or entities owning resources become directly responsible for the maintenance of them. If responsibility for the maintenance of common resources were assigned, then entities could be held responsible for the degradation or pollution it inflicts. Tradeable credit programs attempt to assign ownership of pollution rights to entities and hold entities responsible for pollution they create above the entity's assigned limit.

Credit Trades: The ability to buy and sell pollution credits which are created by entities that are able to reduce their pollution levels below their allotted amount is the last prerequisite for the implementation of a tradeable credit program. The purchase and sales of credits creates a market mechanism that equitably distributes the burden of compliance in the most cost effective manner. "Technically then, more of an input is purchased until the marginal cost of the input,..., equals the marginal revenue product derived from the input" (Anderson et al 24).

To ensure that the market will function properly under a tradeable credit program, there are two conditions that must be satisfied to ensure; 1) there must be sufficient competition within the market being regulated so that on one company is at an unfare advantage over others, and 2) the number of entities being regulated should not be so numerous as to increase transaction costs in excess of any benefit that may be gleened from a tradeable credit program.

Minimum content requirements can be used to demonstrate the mechanics of a tradeable credit program. Pretend for a moment that legislation has been passed requiring the glass container manufacturing industry to utilize secondary materials at a rate of fifty percent. In this fictitious world there are only two manufacturers of glass containers; plant A is currently capable of producing glass containers with forty percent secondary materials and plant B is capable of utilizing forty five percent. Each plant produces one hundred tons of glass containers a year and is responsible for the utilization of fifty tons of secondary material. Due to differences in their manufacturing process, plant A can increase its utilization of secondary materials at a rate of $50 per ton, while plant B incurs a cost of $200 per ton. If these entities were forced to meet the minimum content requirements on their own, plant A would incur a total cost of $500 and plant B would incur a total cost of $1000. If a tradeable credit program were implemented: 1) each entity would be responsible for utilizing 50 percent secondary materials, and 2) each plant would be

allowed the option of paying the other to increase utilization. Plant A would increase its utilization by 15 percent at a total cost of $750 and sell its credits of 5 percent to plant B. Thus, without tradeable credits the total cost of increasing the use of secondary materials to 50 percent is $1500 as opposed to $750 with tradeable credits; a total cost savings of $750.

Attributes of a Successful Tradeable Credit Program: Established goals, assigned ownership, and the ability to buy and sell excess credits generated by the reduction of pollution below the limit set for each entity that owns pollution rights are all prerequisites to the development of tradeable credit policies; however, they do not ensure the success of a tradeable credit program. A successful tradeable credit program will contain some, if not all, of the following attributes: 1) transparent market information to facilitate transfers, 2) monitoring and enforcement capability, 3) reduced overall costs, 4) financial rewards when environmental impacts are reduced, 5) ability to continue to reward progress and innovation, 6) achievement of goals using incentives, 7) equitable distribution of responsibilities, 8) political neutrality, and 9) achievable implementation.

Transparent Market Information to Facilitate Transfers: To facilitate the purchase and sales of credits it may be necessary to ensure that adequate information regarding credits being marketed is available (Heintz and Wirth 10). The creation of new markets may force entities to interact for the first time. This would make it necessary for each entity to familiarize itself with control technologies for a variety of businesses to determine a reasonable price for the purchase or sales of credits. This could be facilitated by something as simple as maintaining a public list of entities held to a specific regulatory goal. If legislation were enacted in conjunction with a tradeable credit program pertaining to integrated waste management, the Board could take on the role of mediator between regulated entities, accumulating pertinent information necessary to facilitate trades.

Monitoring and Enforcement Capability: Monitoring and enforcement capabilities are necessary to ensure that the stated environmental goals are attained and if an entity has not attained its goal, penalties can be levied that are severe enough to create incentives for compliance. If monitoring for compliance becomes too complicated, it could negate the benefits otherwise incurred through tradeable credits (Heintz and Wirth 10).

In some instances the technology for monitoring waste management programs does not exist. When this is the case, the only way to verify compliance is to audit transactions; assuming that it is possible to audit transactions.

Reduce Overall Costs: Under a tradeable credit policy, firms logically "undertake pollution control efforts in precisely the manner and degree which will result in the cost effective allocation of the overall control burden" (Hahn and Stavins 7). After performing an econometric analysis of tradeable emission credit policies versus nontransferable emissions standards, Atkinson and Tietenberg substantiated this claim when they concluded that all "permit designs result in a lower compliance cost at all levels of control than the current...approach which focusses on nontransferable emissions standards" (119).

While total costs can be reduced through the utilization of tradeable credits, transaction costs have the ability to negate any gain made from the trade. Transaction costs for an integrated waste management tradeable credit program would include: 1) any legal fees incurred by industry to facilitate the transfer, 2) regulatory fees incurred by the Board for monitoring and compliance, and 3) research expenditures that may be incurred by the Board or industry during the process of arranging the purchase or sales of credits. Due to the fact that these costs are difficult to quantify it is essential that transactions are kept as simple as possible in an attempt to minimize transaction costs.

Financial Rewards When Environmental Impacts are Reduced: Under a tradeable credit policy, the assignment of ownership sets "the level of control, but charges establish the marginal cost of control" (Hahn and Stavins 10). The marginal cost of control may be achieved at a cost that is below the marginal revenue produced by an additional unit of pollution reduction. When this occurs entities will be encouraged to meet and exceed their environmental goals due to the financial gains that can be realized from the sales of additional credits. In the minimum content requirement example used to demonstrate the mechanics of a tradeable credit policy, plant A is able to increase the utilization of secondary materials at a cost savings of $150 per ton. Plant A will continue to increase its utilization of secondary materials as long as it is able to sell its credits at a profit and plant B will continue to purchase credits as long as the purchasing price is below its cost of increasing the use of secondary materials. Thus, both plant A and plant B receive financial rewards; plant A in the form of profits from credit sales and plant B in the form of avoided costs.

Achieves Goals Using Incentives: Tradeable credit programs use financial mechanisms to create compliance incentives for regulated entities. Entities are given several options to obtain compliance: 1) utilization of control technology, 2) purchase of credits, or 3) face penalties. Each option carries an incentive to comply with the environmental goal. Those entities able to cost effectively utilize control technology to meet environmental goals are provided incentives to exceed

their goals in order to sell generated credits at a profit. The purchase of credits, rather than the utilization of control technologies carries with it an incentive to reduce the cost of compliance. The penalties incurred by entities who fail to comply must exceed the cost of control technology and the cost of purchasing credits to create compliance incentives. In a nutshell, tradeable credit programs should create incentives for entities to pursue the least cost compliance option.

Never Stop Rewarding Progress and Innovation: "Investments in pollution control lead to increased profits under incentive-based systems" (Hahn and Stavins 13). Market-based systems, such as tradeable credits, provide monetary rewards, in the form of profits, for more efficient methods of reducing pollution. If these rewards are eliminated or restricted, then reductions in pollution will cease or be limited due to the lack of incentives to continue pollution reduction through innovative approaches; however, as long as the profits exist, rewards for progress and innovation will persist. An effective tradeable credit program will minimize the amount of restrictions placed on the trade of credits in order to maximize the potential rewards. In the minimum content requirement example used to demonstrate the mechanics of a tradeable credit program both plant A and plant B continue to progress, increasing the level of secondary material to acquire financial rewards as long as the option being developed is more cost effective than the current option utilized. For instance, if plant B discovered a new process which allowed them to increase the use of secondary materials at a cost of $5 per ton, then plant A would purchase credits from plant B to make the difference between its current and required levels of utilization. Plant B would receive rewards for its innovation in the form of profit from sales.

Equitable Distribution of Responsibilities: "Market-based policies equalize the level of marginal costs of control among business rather than the level of control" (Stavins and Whitehead 9). In other words, the burden of compliance will be equalized over all entities due to the fact that those that can reduce pollution most cost-effectively will do so and other entities that incur higher costs for the control will pay them to do so. Referring back to the minimum content requirement example, it can be demonstrated that tradeable credit programs distribute the responsibility of complying with the law more equitably than the imposition of standards. Without a tradeable credit program plant B would be required to pay $150 per ton more than plant A for the same increase in secondary material utilization. This would place plant A at an advantage over plant B because its overhead automatically becomes $150 per ton less. However, if a tradeable credit program were implemented the $150 advantage plant A would have over plant B would be substantially reduced through the sale of credits; creating a more equitable distribution of financial responsibility.

Political Neutrality: Policies that create win-win situations are more likely to be enacted than policies that create losers. Win-win policies are often referred to as politically neutral; the policy is free from opposition. One way to ensure political neutrality is to piggy-back a tradeable credit program onto an existing regulation (Heintz and Wirth 4). This ensures that a policy goal has been pre-established, eliminating the creation of an additional regulatory burden on industry, while allowing industry the flexibility to utilize cost-cutting measures to achieve regulatory goals; thus, a win-win situation is created. It appears that the application of tradeable credits to the Rigid Plastic Packaging Container (RPPC) Act might be a win-win policy for both environmentalists and the industry being regulated. The RPPC Act mandates minimum content requirements for manufacturers. The application of a tradeable credit policy would allow entities the opportunity to pursue the most cost-effective method of complying with the goals of the RPPC Act without compromising the overall intent of the bill. Thus, tradeable credits would constitute a win-win policy; those supporting the legislation would be satisfied because the integrity of the legislation is maintained, and those being regulated are given more options to facilitate their compliance.

Achievable Implementation: If a regulatory structure does not exist that is conducive to a tradeable credit program, then a regulatory approach which minimizes the costs to the government, including transaction costs, must be developed. The "single most important thing for government regulators to keep in mind in trying to design a market-based system is to keep the process as simple as possible" (Hayward 7). To achieve the dual objectives of simplicity and cost minimization, there must be access to inexpensive and accurate monitoring mechanisms, along with a minimum amount of restrictions on trade. If a fairly simple implementation of the regulatory process is not possible at a reasonable cost, then the program's success will be minimized, possibly negated.

Lessons Learned in Other Environmental Fields

Thus far, only the theory of tradeable credits has been discussed. Case studies are needed to acquire a working knowledge of the practical aspects of tradeable credits. There are very few tradeable credit programs that have been implemented and even fewer programs that have been in existence long enough to draw any conclusions regarding the success of the program. The following case studies focus on: 1) lead trading, 2) the trade of phosphorous discharge credits at the Dillon Reservoir, 3) water quality exchanges for the Fox River, and 4) air emission credit trading. These programs were chosen for examination due to the availability of literature

Lead Trading: In 1982 the U.S. EPA instituted a program which phased-out the use of lead in gasoline. This program utilized tradable credits. A stepped approach was used to reach the EPA's goal which was to phase-out lead in gasoline by December 31, 1987. In 1982 each refinery was issued a permit to utilize lead in the production of gasoline at a reduced level. The amount of lead permitted in gasoline at each refinery was determined by reducing the amount of lead by a certain percent based on the refinery's use of lead in 1982. These permits expired yearly and new permits with reduced lead limits were issued. In 1985 a banking program was introduced which allowed refineries to save, or bank, their credits for future use or future sales. The EPA placed no restrictions on the trade of lead credits; however, before banking was introduced, credits could not be carried over from year to year. The lead credit trading program was highly successful. Over half the refineries in the U.S. engaged in trading that resulted in savings estimated to be hundreds of millions of dollars (Hahn and Hester 387). The success of this program can be attributed to three elements: 1) pre-existing market and regulatory structure, 2) the distribution of compliance responsibilities, and 3) financial incentives.

The pre-existing market structure in the refinery industry facilitated the flow of market information, while the established regulatory practices used to monitor refineries ensured that an implementation plan with strong monitoring and enforcement capabilities could be developed. The volume of trade that occurred can be attributed to the "well-established markets in refinery feedstocks and products", which resulted in "personnel at different refineries who were accustomed to conducting transactions with each other" (Hahn and Hester 390). The familiarity within the industry facilitated the flow of information regarding the availability of lead credits. The use of pre-existing reporting mechanisms facilitated the smooth implementation of the program including monitoring and enforcement capabilities.

The distribution of compliance responsibility not only ensured that the burden of compliance was shared equitably, it also politically neutralized the policy by creating a win-win outcome for all the players. A phase-out of lead in gasoline was planned before the tradeable credit program was established. Without tradeable credits all entities would have been required to adhere to the same standards. It is likely that a number of smaller refineries would not have been able to absorb the large capital costs needed to retrofit refineries for the production of gasoline without lead. Tradeable credits were incorporated into the phase-out plan in an attempt to give smaller refineries flexibility in the approach they utilized to ease lead out of the refining process. The trading of lead credits ensured that an equitable distribution of the cost of compliance was achieved by allowing those able to most cost-effectively absorb the compliance costs the ability to do so and those

experiencing higher costs of compliance an opportunity to pay a lower cost to comply with the law by purchasing lead credits. This allowed entities an opportunity to pay the lowest marginal cost of compliance.

The financial mechanics of the lead phase-out tradeable credit program ensured that incentives were created to achieve the environmental goals with reduced overall costs. Transaction costs were held to a minimum by using pre-existing record keeping methods that refineries were already using to monitor compliance, restrictions on trade were minimized and market information was plentiful; all worked to reduce the overall costs of the program. Financial rewards existed for those able to develop original approaches to the elimination of lead in gasoline in an attempt to sell any credits created at a profit.

The lead trading program closely resembled a fully functioning free market. Buyers and sellers of credits were able to engage in trade with a minimal amount of interference impeding the equitable distribution of the compliance burden.

Dillon Reservoir, Colorado: The Dillon Reservoir phosphorous trade program was established in 1984 in an attempt to mitigate environmental damage caused by point and non-point phosphorous discharge into the Dillon Reservoir. Point and non-point sources refer to stationary and diffused sources, respectively. The main contributing point source was sewage treatment plants; non-point sources included primary septic systems and urban runoff (Hahn and Hester 394). The large disparity in the costs of control prompted officials to pursue a tradeable credit program. Point source controls were estimated to cost as much as $860 to remove one pound of phosphorous, while non-point sources were estimated at $119 to remove one pound of phosphorous (Hahn and Hester 394). New non-point sources are required to use appropriate control technology or obtain credits to offset their phosphorous discharge so that the collective goal is maintained (Levitas and Rader 12). Due to the difficulty associated with monitoring reductions in non-point phosphorous discharge, a conservative approach was taken in which point/non-point transactions are required to occur at a 1:2 ratio; thus, one unit of point source reduction has to be offset by two units of non-point reduction (Hahn and Hester 394). Point sources are required to install non-point control mechanisms instead of purchasing credits (Hahn and Stavins 18). This requirement eliminates the need for regulatory agencies to assign specific environmental responsibility to non-point sources which are difficult to determine. It also enables point sources to realize minimal transaction costs by allowing them to install controls directly instead of purchasing credits from non-point sources of pollution that are likely to add a profit margin to the cost of control. While non-point sources are

not held individually responsible for reaching a phosphorous discharge goal, a collective goal for all non-point phosphorous discharged has been established.

Although this program incorporates low transaction costs, monitoring capabilities, political neutrality and financial incentives for finding innovative ways to reduce phosphorous discharge, improved operating efficiency of sewage treatment plants reduced the amount of phosphorous discharge below the goals set in the trade program for point sources. This negated the original intent of the program to facilitate point/non-point trades; however, non-point/non-point trades have occurred. New non-point sources created by housing developments and the like have used the trade system to pay for other non-point controls which are less expensive than the control measures needed for their discharge (Levitas and Rader 12).

Although the Dillon Reservoir trade program does not function as it was intended, the program has been successful in meeting its goals by utilizing market mechanisms. The creation of control trade mechanisms allows both point and non-point sources to utilize market forces to allocate resources in the most cost-effective manner.

Fox River, Wisconsin: In 1981 Wisconsin enacted legislation to limit waste discharged into the Fox River which increases biological oxygen demand (BOD). Under this legislation only point sources are regulated, more specifically paper mills and municipal wastewater plants. These regulations assign property rights to discharge BOD to point sources which can be traded "only if the plant acquiring rights is new, or is increasing its production, or is unable to meet the discharge limits in its permit despite optimal operation of its treatment facilities" (Hahn and Hester 392). Permit rights that have been traded expire when the seller's permit is terminated, a maximum of five years. Due to the restrictions imposed on trades, the program's results have been dismal. Initial estimates projected that a savings of $7 million per year would be realized due to trades; however, in "the six years that the program has been in existence, there has been only one trade" (Hahn 97-98).

Restricting trade to new or expanding plants, or entities that have exhausted all other control measures creates: 1) disincentives to trade, 2) an unequitable distribution of control responsibility, and 3) increased total costs. One of the main foundations of a tradeable credit program is the ability to trade freely. By restricting trade to entities that have exhausted all other control options, Wisconsin has simply attached a tradeable credit program to a command and control policy. Most pollution control standards are based on projected reductions that can be realized if the best available control technology (BACT) were used. By necessitating that all control technology

available be used, in essence, Wisconsin has ensured that the limit will be met and the need for trading will be negated. Mandating the use of control technology also assures higher total costs. Instead of seeking out firms that are able to most cost-effectively control BOD, entities are forced to utilize control technology regardless of cost. This increases the total cost of control and prevents costs from being equitably distributed because some firms will be paying substantially more than others for the same amount of control.

The expiration of permits also contributes to the failure of this program. Information regarding the status of traded credits after the expiration of the seller's permit is unavailable; thus, entities are less likely to risk losing a purchased credit and trades are less likely to occur. The uncertainty of the permit market combined with restrictions on trade are undoubtedly the two major downfalls of this trade program.

Air Quality, United States Environmental Protection Agency: The United States Environmental Protection Agency (EPA) established an emissions trading program in 1974 in an attempt to allow greater flexibility to firms trying to comply with the Clean Air Act. Under the trading program property rights are assigned and traded which allow entities to emit specific types of air pollutants. For the implementation of this program, the EPA segmented the U.S. into 247 air districts which either meet air quality standards, referred to as attainment areas or do not, which are referred to as non-attainment areas. EPA regulations allow two types of trade: 1) internal trades which occur within the same firm having multiple emission sources, and 2) external trades which occur between firms. The EPA has established the basic terms of trade for emissions; however, it is up to the state to determine if and which segments of the program will be implemented. In some cases, state governments are also responsible for implementation. Currently, the EPA allows states to engage in four types of emission credit trading: 1) netting, 2) bubbles, 3) offsets, and 4) banking.

Netting allows entities the opportunity to continue emitting pollutants that have been controlled if a source within the same firm reduces its emissions by an equal amount. Netting is controlled at the state level and is exclusively an internal trade. Estimates for the number of netting transaction that have occurred as of 1989 range between 5,000 and 12,000 (Hahn and Hester 373). Estimated cost savings from netting range between $525 million and $12 billion for the same time period (Hahn and Hester 373).

Bubbles are created when a limit to the amount of emissions is imposed on a single plant with multi-source emissions. Credits are created when one source reduces emissions allowing another

source to produce more emissions so long as aggregate emissions do not surpass the established limit. Between 1974 and 1989 an estimated 150 bubbles were created at an estimated savings of $435 million (Hahn and Hester 374). Trades utilizing bubbles have been approved at both the state and federal level.

In non-attainment areas, offsets are required for new entities or entities wishing to expand production, commonly called modified sources. Offsets refer to new or modified sources obtaining credits from existing sources in order to offset the amount of emissions the new or modified source will produce. This provision allows new and expanding entities an opportunity to engage in business without further eroding the air quality in non-attainment areas. The number of offset transactions reached 2000 in 1989 (Hahn and Hester 373). A cost savings for offsets can not be determined because offsets "result in no direct emission control cost savings because the use of offsets does not allow a firm to avoid any emission limits" (Hahn and Hester 375).

Banking allows firms to create emission credits for use at a later date. Between 1974 and 1989 only 100 banking transactions were approved. This may be due to the fact that the EPA has left the development of banking programs largely to the states, which may discourage them due to the high costs associated with developing these programs.

The EPA's emission trading program has been somewhat successful; however, greater success could be attained if access to information were expanded, monitoring devices were readily accessible and permits were conducive to the achievement of air quality goals. Lack of access to information inhibits some states from developing emission trading programs. Many states have found that the cost of obtaining information to develop a program too great or that the necessary information is unavailable. Much of the information regarding emissions is obtainable only by utilizing expensive monitoring equipment. In addition, historical data is often difficult, if not impossible, to obtain. For example, the banking program requires access to historical information regarding emissions, in some cases this information is impossible to obtain because historical data has not been kept or is incompatible with accounting systems now required. If the EPA had specified more complete information regarding the implementation of tradeable credit programs, less investment in acquiring information would be needed and more states would be likely to participate in emission trading programs.

Air quality throughout the U.S. varies greatly. The type and amount of pollution needed to cause adverse effects to air quality varies greatly between the 247 air districts throughout the U.S.;

however, permit limits have been set uniformly for all firms in varying districts. In some instances the air quality standards set by "individual source permits (are) not sufficiently stringent enough to enable states to attain air quality standards" (Hahn and Hester 115). This makes it possible for all the firms within a district to be in compliance, without the district itself attaining air quality goals. If individual permit limits were stringent enough for all districts to meet their air quality goals, more trade would occur.

While the EPA's emission trading program has had its faults, it also has had its successes. The large volume of trading which has occurred in netting and bubble programs is due to lower transaction costs associated with internal trades and the decentralization of some aspects of the programs. Internal trades facilitate the reduction of transaction costs by eliminating the need to acquire market information and the elimination of the seller's profit. Flexibility in meeting permit requirements was facilitated by the decentralization of decision making. Netting and bubble programs allowed firms the flexibility of deciding which sources within the firm are most cost effective to control and which sources should be allowed to maintain or increase emissions. These programs decentralize decision making, allowing individual firms to determine the most cost effective mixture of controls to pursue.

Applications to Waste Integrated Management

Tradeable credits can be applied to four different types of integrated waste management programs: 1) minimum content and other product requirements, 2) utilization requirements, 3) multiple compliance options, and 4) diversion requirements. The following section explains the mechanics of each application and provides examples, including a discussion of whether the option given as an example is likely to benefit from a tradeable credit program.

Minimum Content: Minimum content laws require that entities use a certain amount of postconsumer or secondary material in the production or purchase of a new product. In California, there are four such laws that have been fully implemented: 1) printers and publishers in California are required to ensure that at least 50 percent of the newsprint they use is manufactured from at least 40 percent postconsumer fiber by weight by the year 2000, 2) trash bags made or sold in California, which exceed a specified thickness, are required to contain at least 30 percent postconsumer material by 1995, 3) glass bottles are required to attain increasing levels of secondary content until the year 2005, and 4) fiberglass building insulation made or sold in California is required to be produced with specified percentages of glass cullet.

Theoretically, a tradeable credit program could be implemented in conjunction with any of these, or other minimum content mandates. This paper will use California's newsprint legislation to illustrate the mechanics of applying a tradeable credit program to minimum content legislation.

The California law mandating printers and publishers to ensure that 50 percent of the newsprint they use contain a minimum of 40 percent postconsumer fiber involves a stepped approach. The current minimum use requirement is at 25 percent, increasing to 30 percent by 1994, 35 percent by 1996, 40 percent by 1998, and 50 percent by the year 2000. A tradeable credit program would apply this goal to all newsprint. Responsibility for meeting specific goals could then be assigned to individual printers and publishers, and credit trades could be facilitated.

Instead of assigning the "right to pollute" as do many other tradeable credit programs, when applied to minimum content for newsprint, the "right to use virgin materials" is assigned. Currently, printers and publishers are free to use up to 75% virgin newsprint. The assigned amount of virgin newsprint that can be used then decreases by 5 percent every other year until the year 2000 at which time the requirement stays at 50 percent.

In some instances, printers and publishers may be able to increase their use of recycled-content newsprint above that year's requirement, creating recycled-content newsprint credits. These credits could then be sold to printers and publishers who find it advantageous to purchase credits rather than reduce their use of virgin materials.

The free flowing trade of credits is the last element which must be incorporated into a tradeable credit program. This should be accomplished by imposing as little government interference as possible in an attempt to keep transaction costs to a minimum. The fact that the minimum content law for newsprint utilizes a stepped approach to reaching its goal dictates that an additional concern be addressed: will the credits exchanged expire every other year when the minimum content requirement increases? If credits were to expire, printers and publishers would be required to acquire new credits. However, if they were allowed to bank credits they could carry them over into the following year for use or trade.

The mere ability to adapt a tradeable credit program to a minimum content law is not enough to ensure that tradeable credits will produce benefits. The attributes outlined earlier in this paper must also be present. In addition, the application of tradeable credits must avoid the creation of monopolies which give a single entity, or a small number of entities, an unfair advantage over the

others being regulated.

If a tradeable credit program were implemented in conjunction with the minimum content law that regulates newsprint, the application of tradable credits would do little to increase minimum recycled content newsprint use due to the fact that 67 percent of all newsprint used in California is recycled content newsprint. This exceeds the maximum requirement of 50 percent by 17 percent.

In addition, it is likely that a very small number of entities would control the majority of credits, creating a monopolistic or and oligopolistic[4] market for credits. In 1992 there were two entities that consumed approximately 53 percent of the total amount of recycled content newsprint used in California. One entity utilized 100 percent post-consumer fiber and consumed 40 percent of the total newsprint used in California. The other entity utilized 80 percent post-consumer fiber and consumed 13 percent of the total newsprint used in California[5]. Together, these two entities utilized post-consumer fiber at a rate in excess of the 50 percent utilization rate requirement mandated for the entire industry in the year 2000. If a tradeable credit program were implemented, the two entities comprising the oligopoly would be able to sell credits equivalent to approximately 25 percent of the total utilization needed to meet the industry goal. Thus, those involved in the oligopoly would have an unfair advantage over the others being regulated. Additional credits or investments in de-inking capacity would need to be utilized only if manufacturers increased production or another firm wished to enter the market; thus, incentives for technology utilization and the creation of additional credits are minimal.

The application of tradeable credits to minimum content requirements exemplifies the need to examine the application of tradeable credits to minimum content laws on a case by case basis. The characteristics of a given market and the specifics of minimum content legislation should determine whether the application of a tradeable credit program is appropriate.

Utilization Rates: Utilization rates require manufacturers to ensure that a specific amount of the primary materials used in their products are utilized as secondary materials. The mechanics of this type of program are almost identical to those of a generic tradeable credit program: 1) a goal is

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[4]Oligopolistic refers to a market situation in which very few entities control a commodity or service.

[5]This information was gleaned from a database developed by Kay Oro, staff at the Integrated Waste Management Board.

assigned to an industry, 2) responsibility for a certain portion of the goal is assigned to each entity within the regulated industry, and 3) trades are allowed to occur. The two programs diverge in that, under a utilization rate program, utilization can occur either within the same industry or outside of that industry, providing greater flexibility for the regulated entity. On the other hand, tradeable credit programs usually restrict the number of entities that can participate by requiring compliance to occur within a single or specified number of industries and often within a specific jurisdiction, resulting in a more efficient monitoring system. Despite these differences, tradeable credits could theoretically be used in conjunction with a utilization rate program.

Utilization rates have the potential to be applied on a broad basis affecting many types of products or packages. Tradeable credits could be used as a compliance mechanism. However, the application of tradeable credits to utilization rates, would be redundant, with the possibility of negating any benefit either program would provide on a stand alone basis. If these two programs were implemented together, manufacturers would not only be responsible for ensuring that a specified amount of secondary material were utilized, they would also be responsible for supplying paperwork to the regulating entity to prove that the credits were generated before they were exchanged. By requiring manufactures to submit proof of compliance and requiring the credit to be generated before it is sold, manufacturers would be subject to an additional layer of bureaucracy that would not be present under a program that relied exclusively on minimal documentation to demonstrate utilization. Additionally, by expanding the regulated population to be consistent with utilization rate programs, the ease of monitoring often associated with tradeable credit programs would be negated by the need for each participant to prove compliance which could pose a monitoring problem for the regulating entity due to the large volume of records that would need to be reviewed. A low compliance rate may result due to the fact that regulators would be unable to conduct frequent audits. Thus, the benefits associated with both programs, ease of monitoring and flexibility, are negated.

There is no cut and dry prescription for applying tradeable credit and utilization rate programs to integrated waste management policies. Each proposal should be analyzed on its own merit and the decision to implement any particular program should be made on a case by case basis. The goal of the policy is likely to dictate the type of program implemented: tradeable credits which result in high compliance rates or utilization rates which offer entities maximum flexibility.

Multiple Compliance Options: The possibility of applying tradeable credits should also be examined for legislation that offers multiple compliance options. SB 235, or the Rigid Plastic Packaging

Containers (RPPC) Act, requires manufacturers of RPPCs to achieve one of four compliance options: 1) source reduction, 2) reuse and refill, 3) recycling rate, or 4) postconsumer content.

In their "Conceptual Plan to Implement the Rigid Plastic Packaging Container Act", Ernst & Young[6] recommend the use of tradeable credits to help those entities that must also comply with regulations imposed by the U.S. Food and Drug Administration (FDA) comply with the RPPC Act.[7] Ernst & Young advocate applying tradeable credits to all compliance options. However, they suggest prohibiting trades across unlike options. This has the dual effect of allowing regulated entities more flexibility to achieve compliance, while streamlining the monitoring process by alleviating the need to arbitrarily weigh the alternatives relative to each other to create the credit conversion factor necessary for trades between unlike compliance options.

Although the tradable credits option would be available to all program participants, it is of special benefit to those entities that manufacture products regulated by the FDA. These entities have expressed concern over their ability to simultaneously comply with the RPPC Act and FDA regulations, but a tradable credits program would allow them to remain in compliance with FDA regulations and still contribute to the RPPC Act's goals. Thus, by instituting a tradable credits program, the scope of regulated entities is maintained and additional source reduction, recycling, reuse, or postconsumer content use occurs. This ensures that one of the goals of the RPPC Act, to increase the amount of recycled material in RPPCs, can be achieved.

If a tradeable credit program is not implemented in conjunction with the RPPC Act, then one of two things will likely occur: 1) entities regulated by the FDA may choose not to pursue recycling rate options and, therefore, may be unable to comply with any of the options and will face penalties, or 2) exemptions will have to be granted. Neither scenario increases the amount of recycled material in RPPCs.

Incorporating a tradable credits component into the RPPC Act's framework is compatible with the

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[6]Ernst and Young is a contractor that was commissioned by the Board to develop the implementation plan for SB 235.

[7]Entities regulated by the FDA have stated they are constrained in their ability to comply with SB 235's provisions. They are constrained because the FDA regulates their ability to reuse, refill, or use postconsumer content in RPPCs, they have already source reduced to the margin and cannot forsee additional opportunities for source reduction in the near future, and the recycling rates are beyond their control.

Act's goals, and, because many entities claim they will have difficulty achieving compliance, tradable credits may actually result in increased waste diversion and/or postconumer material usage. In the future, it will be necessary to examine the merits of applying tradeable credits to multiple compliance option legislation on a case by case bases. Not only is it necessary to examine the market in which the exchanges will occur vis a vis each compliance option, it is also necessary to evaluate the effects that the application of tradeable credits could have on compliance options vis a vis each other.

Attaining AB 939 Goals: Tradeable credits could be applied to waste diversion goals mandated by AB 939. In essence, property rights have already been assigned to local jurisdictions who are responsible for reducing their waste by 25 percent in 1995 and 50 percent in 2000. If jurisdictions were allowed to trade credits created by diverting waste in excess of their mandated goal, lower total costs could be achieved without jeopardizing statewide waste diversion goals. Current reporting requirements embodied in SRRE's and annual reports could be expanded to include a reporting element for trades. Monitoring practices could be facilitated by the current law which calculates diversion at the landfill, and any additional diversion would be calculated with or without the existence of tradeable credits; thus, adding nothing to transaction costs.

AB 2494, which was incorporated into the Integrated Waste Management Act, allows the formation of regional agencies by cities or counties that are located in a rural area and have a combined population of 250,000 or less. Some have equated regionalization to tradeable credits, however, this is not the case. By limiting the size and geographical proximity in which regionalization can take place, the incentive to combine efforts is greatly diminished. Many rural areas that are close in proximity share similar if not identical waste management problems. Unless these cities or counties are planning to take advantage of economies of scale, there is little benefit to regionalization. Even if the cities and counties do not all share the same waste management problems, why would one city or county want to take on the problems of another, receiving nothing in return?

A tradeable credit policy would allow all cities and counties to specialize in their area of waste diversion expertise generating credits to sell to counties unable to cost-effectively divert their waste. Like regionalization, a tradeable credit program would also create incentives for some jurisdictions to take advantage of economies of scale and invest in diversion technology that would otherwise fail to be cost-effective. However, unlike regionalization, tradeable credits would also spread the costs of compliance more equitably across jurisdictions, possibly allowing smaller

jurisdictions with limited waste management infrastructure an opportunity to realize lower waste diversion costs.

While the benefits of a tradeable credit program could be significant, some would argue that a tradeable credit program would detract from the intent of AB 939. AB 939 mandates that each jurisdiction reduce its waste, not a collective reduction for the state. It could be argued that the intent of holding individual jurisdictions responsible for waste reduction is an attempt to ensure that all Californian's alter their waste disposal habits. In this case, a tradeable credit program would be contrary to the intent of the law because the purchase of credits would allow a community to continue its waste disposal practices. If the intent of AB 939 was to indeed modify public behavior, then tradeable credits would definitely defeat this purpose; however, if the goal is to most efficiently reduce California's waste by 25 percent in 1995 and 50 percent in 2000, then tradeable credits could facilitate a cost-effective method of attaining that goal.

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