ILLINOIS POLLUTION CONTROL BOARD
March 8, 1984

In the matter of:)
)
PROHIBITION ON LANDFILLING) R81-25
OF HALOGENATED SOLVENTS (CBE))

PROPOSED RULE. FIRST NOTICE

SECOND PROPOSED OPINION OF THE BOARD (by D. Anderson):

On September 23, 1981 Citizens for a Better Environment (CBE), an Illinois not-for-profit corporation, filed a proposal for adoption of a rule prohibiting disposal of chlorinated solvents at landfill sites. The proposal was authorized for hearing and appeared in the Environmental Register on November 6, 1981. On February 3, 1982 CBE amended the proposal to conform with codification requirements and to state the relationship with the newly adopted RCRA rules. The amended proposal was for adoption of 35 Ill. Adm. Code 729, a separate Part prohibiting landfilling of hazardous wastes in RCRA or any other facilities.

The Board held two merit hearings on the proposal as follows:

1.	February 23, 1982	Springfield
2.	March 8, 1982	Chicago

Following the second hearing the matter was referred to the Department of Energy and Natural Resources (DENR) for preparation of an economic impact study: "The Economic Impact of Proposed Regulation R81-25: Prohibition of Chlorinated Solvents in Sanitary Landfills," DENR Doc. No. 83/08 (Exhibit 2). Two economic impact hearings were held:

3.	March 31, 1983	Urbana
4.	April 15, 1983	Chicago

The Board received six public comments during and after the merit and economic impact hearings:

PC1	Monsanto Chemical Intermediates, February 19, 1982
PC2	Illinois Manufacturers' Association, March 8, 1982
PC3	Illinois Environmental Protection Agency, March 26, 1982
PC4	Caterpillar Tractor Company, April 21, 1983
PC5	Illinois State Fabricare Association, April 28, 1983
PC6	Citizens for a Better Environment, May 2, 1983

On May 5, 1982 the Board adopted a first notice Order and a Proposed Opinion. The proposal appeared at 7 Ill. Reg. 6276, May 20, 1983. The comment period was extended on July 14, 1983. Following the First Notice, the Board received the following public comments:

PC7	Halogenated Cleaning Solvents Association
PC8	E. I. Dupont de Nemours and Company
PC9	National Solid Wastes Management Association
PC10	Illinois Environmental Protection Agency
PC11	Caterpillar Tractor Company
PC12	Waste Management of Illinois, Inc.
PC13	Citizens for a Better Environment
PC14	National Solid Wastes Management Association
PC15	Illinois Manufacturers' Association
PC16	National Solid Wastes Management Association
PC17	Waste Management of Illinois
PC18	Administrative Code Unit
PC19	Waste Management, Inc.

On July 5, 1983 Waste Management of Illinois, Inc., (Waste Management) filed a motion to reopen for the purpose of presenting testimony concerning trace levels and concentration exemptions. On August 18, 1983 the Board granted Waste Management's motion. Four hearings were held as follows:

5.	October 7, 1983	Chicago
6.	October 13, 1983	Chicago
7.	October 14, 1983	Chicago
8.	October 24, 1983	Chicago

At the conclusion of the hearings CBE and Waste Management waived their right to comment under Section 102.163, with the understanding that the Board would enter some form of revised proposal and allow comment prior to Second Notice. Accordingly, the Board will withdraw the Proposed Opinion and Order of May 5, 1983 and adopt a Second Proposed Opinion and a Second First Notice Order.

Changes from First First Notice Order

The following is a brief summary of the major differences between the first and second First Notice Orders:

1. The applicability of the entire Part has been restricted to hazardous waste as defined in Part 721 (Section 729.100).

2. A Section has been added to avoid the interpretation that the Board is proposing to require certain methods of analysis of waste on receipt by landfills (§729.123).

3. Variance and site specific procedures have been referenced (§729.140).

4. The prohibition on landfilling diluted materials has been deleted, although the dilution itself would still be prohibited (§729.201).

5. Definitions of terms have been added (§729.220).

6. Halogenated "compounds" have been distinguished from halogenated "solvents", with the latter term reserved for non-aqueous liquid phases containing halogenated compounds (§§729.221 and 729.222).

7. Total organic halogen content has been substituted as an alternative method for judging the presence of halogenated compounds (§729.222).

8. Halogenated compounds are presumed to reside preferentially in organic phases (§729.224).

9. The threshold level for halogenated compounds in organic phases has been changed from 1 ppm to about 1% (§729.240).

10. The threshold level for aqueous solutions has been increased from 100 ppm to about 1%.

11. Measurement of concentrations in solids has been shifted from the bulk waste to any organic phase, and the ban has been deferred to 1986.

Legislative History

Section 22(h) of the Environmental Protection Act (Act) allows the Board to adopt requirements to prohibit the disposal of certain hazardous wastes in sanitary landfills. This was added by P.A. 81-1484, effective September 18, 1980.

Section 39(h) of the Act provides that after January 1, 1987 a hazardous wastestream may not be deposited in a permitted hazardous waste site unless specific authorization is obtained from the Agency by the generator and disposal site owner. This was added as Section 39(f) of P.A. 82-572, effective July 1, 1983.

Section 22.6 of the Act provides that no person shall dispose of any liquid hazardous waste in any landfill without specific authorization by the Agency, and authorizes Board regulations which prohibit or set limitations on the type, amount and form of liquid hazardous wastes which may be disposed of in landfills. This was added by H.B. 1054 during 1983.

The Illinois Manufacturers' Association asked the Board to defer action on the CBE proposal until H.B. 1054 was finalized (PC 15). The Board declined to do so, noting that its authority under Section 22(h) is broader, extending, for example, to solid as well as liquid hazardous wastes. The Board intends to review Part 729 in a later rulemaking to determine whether any changes should be made with respect to H.B. 1054.

RCRA

On February 4, 1982 the Board adopted regulations to allow Illinois to be delegated Phase I RCRA authority under the Resource Conservation and Recovery Act (42 U.S.C. §6901) (R81-22, 6 Ill. Reg. 4828, April 23, 1982). Phase I authorization was received on May 17, 1982 (47 Fed. Reg. 21043). The Phase I rules were amended on January 13, 1983 (R82-18, 7 Ill. Reg. 2518, March 4, 1983). On July 26, 1983 the Board adopted rules to allow Illinois to obtain final authorization (R82-19, 7 Ill. Reg. 14015, October 28, 1983). These were amended in R83-24 and R83-39, December 15, 1983.

Part 729 deals primarily with hazardous waste disposal. It has therefore been placed, with the RCRA operating requirements, in Subchapter c of Chapter I, Subtitle G.

Section 22.4(b) of the Act allows the Board to adopt regulations relating to a State hazardous waste management program that are not inconsistent with and at least as stringent as the RCRA Act and regulations, in accordance with the procedures of Title VII of the Act and Section 5 of the Administrative Procedure Act (APA). The Board has followed and will follow these procedures in this rulemaking. The Board finds that Part 729 is not inconsistent with and at least as stringent as the RCRA Act and rules. Section 22.4(b) will be added to the main authority note in the proposed rules.

RELATIONSHIP TO OTHER LANDFILLING BANS

Sections 724.414 and 725.414 contain special requirements for placement of liquid waste or waste containing free liquid in a landfill. The wording is identical, but Section

724.414 applies to permitted landfills, while Section 725.414 applies to interim status landfills. These Sections allow the landfilling of bulk liquids in landfills with liners and a leachate collection and removal system meeting the requirements of Section 724.401(a). Alternatively, bulk liquids may be mixed with absorbent and placed in a landfill meeting the interim status standards of Part 725, or the final standards of Part 724. Containerized liquids are prohibited from all RCRA landfills unless "free-standing liquid" has been removed or mixed with an absorbent.

Section 22.6(a) of the Act, as amended in 1983 by H.B. 1054, prohibits the landfilling of "liquid hazardous waste" after July 1, 1984, except with specific authorization from the Agency.

The proposed prohibition on chlorinated solvents is pursuant to Section 22(h) of the Act. It addresses the following types of waste:

1. Wastes containing a non-aqueous liquid phase which is an halogenated solvent.
2. Aqueous wastes containing more than 1% halogenated solvents in dissolved form.
3. Solid wastes which contain a free liquid which is an halogenated solvent.
4. Solid wastes which, when mixed with water, form a non-aqueous liquid phase which is an halogenated solvent.

This proposal bans wastes which are also banned under the RCRA provisions or Section 22(h) of the Act: wastes 1, 2 and 3 either are liquids or contain free liquid. The proposal differs from the existing bans in the following respects:

1. Solids which form a non-aqueous liquid phase which is an halogenated solvent are also banned.
2. Addition of absorbents to non-aqueous liquid phases is prohibited.
3. The proposal could become effective before July 1, 1984.
4. Placement of bulk liquids in a landfill with a liner and leachate collection and removal system is prohibited.

5. The small quantity rule is set at 1 kg of halogenated compounds per month, which may be more stringent than the 100 kg per month of waste for applicability of the RCRA rules under Part 721.

CATEGORIZATION OF WASTES

The General Assembly has made the landfill prohibitions a centerpiece of the State's solution to the perceived threat of hazardous waste. As it moves into Section 22.6 rulemaking, the question before the Board will become primarily how it will define waste categories, the order in which it will address them and the exemptions from the statutory bans which it will allow. Although Section 22(h) is not self-implementing, it too leaves the Board with complete discretion as to the categorization of hazardous wastes and the order in which it addresses the categories of waste.

Some of the comments and testimony suggest that the landfilling of hazardous waste is acceptable. This has been addressed by the legislature.

Other comments and testimony suggest that improved landfill designs, such as synthetic liners and leachate collection and removal systems, have resolved the perceived problem with landfilling hazardous waste (R. 431, 542, 1109, 1122). However, the legislature adopted new landfill prohibition requirements during the last session without drawing this distinction. Indeed, there is no language in Section 22(h) or in the new Section 22.6 which establishes the type or design of the landfill as a basis for consideration. The Board therefore rejects as contrary to the legislative intent any broad exemption based on landfill design. However, the Board may establish different phase-in schedules or concentration rules depending on the type of landfill.

The order in which categories of waste are addressed depends on several factors:

1. Ease with which the waste category can be defined;

2. Availability of information concerning the waste category;

3. Quantity of waste being generated;

4. Quantity of waste being recycled in the absence of regulations;

5. Whether a proposal has been filed with the Board;

6. The ultimate risk to public health or the environment if the waste or degradation products were released;

7. The probability that the waste or degradation products will be released into the environment as a result of landfilling;

8. The persistence of any resulting contamination and the ease with which any resulting contamination can be cleaned up.

9. The availability of recycling, treatment or alternative disposal technology.

At the time the decision is taken whether to proceed to hearings on a proposal, this information is necessarily limited. In the present matter, chlorinated solvents is an easily-defined category. California has regulated halogenated solvents as a category (R. 324, 342, 346, 351, 355, 365, 388). At least some information on the category was available. Most importantly, a proposal had been filed with the Board.

As is discussed below, chlorinated solvents are generally recognized as toxic and very persistent. They are organic solvents which pose a threat to synthetic liners as a class, although it is possible that a liner may be found which is resistent to any given solvent. As organic solvents, they also pose a threat to clay liners. They have appeared in monitoring wells around hazardous waste landfills.

The best reason for delaying action on chlorinated solvents, and proceeding with other categories first, is that there is a recycling industry already in place and that the waste is widely recycled on economic grounds. However, this is certainly no reason not to take action on the category; indeed, it is a part of the finding which the Board must make to ban the waste.

TOXICITY

The chlorinated compounds involved in this rulemaking are, as a class, toxic compounds. Depending on the nature of the exposure and the particular compound, their toxic effects are the following:

1. Cardiovascular, including changes in the pulse rate, arrhythmias and changes in blood pressure (R. 10, 1013, 1030, Ex. 1A, 1C, 1D, 1E);

2. Bronchopulmonary, including irritation, bronchoconstriction, pulmonary congestion and respiratory depression (R. 10, 1030, Ex. 1A, 1C, 1D, 1E, 1F);
3. Organ damage, especially to the liver and kidneys, including swelling of the liver, fatty deposits and liver dysfunction (R. 10, 12, 1013, 1023, 1030, 1040, Ex. 1A, 1E, 1G);
4. Gastrointestinal, including nausea, vomiting and diarrhea (R. 12, Ex. 1E, 1F);
5. Central nervous system, including central nervous system depression, headache, dizziness and staggering gait (R. 10, 30, 1030, Ex. 1A, 1B, 1E, 1G);
6. Skin, including chloracne, dermititis, cracking and irritation (R. 12, 90, 1036, Ex. 1F, 1G);
7. Accumulation of carboxyhemoglobin, equivalent to carbon monoxide poisoning (R. 11, 90, 119, 1036, 1048, 1081, 1096, Ex. 1B);
8. Fetotoxicity and teratogenicity (R. 14, 105, 1014, 1017, 1037, Ex. 1A, 1B, Ex. 33, p. 7(a));
9. Mutagenicity (R. 105, 1014, 1037, Ex. 1A);
10. Carcinogenicity (R. 13, 101, 105, 1014, 1031, 1043, Ex. 1A, 1F, 3A).

The toxic effects shown by the individual halogenated compounds involved in this rulemaking are summarized in the sections which follow.

CHLOROBENZENE

Chlorobenzene damages the liver and kidney of test animals (Ex. 1A, Ex. 2, p. 27). A recent bioassay test provided some indication of carcinogenicity, but was not conclusive (R. 209, Ex. 3A).

ORTHODICHLOROBENZENE

Orthodichlorobenzene damages the liver and kidneys (R. 12, 14, Ex. 1A, 1F and 1G, Ex. 2, p. 28). It causes irritation to the lungs, vomiting and dermititis in occupational exposure (R. 13, Ex. 1F). It is mutagenic and a suspected carcinogen (R. 209, Ex. 1A, Ex. 3A).

CHLORINATED FLUOROCARBONS

This is a generic listing; there are two other specific chlorinated fluorocarbons also listed. As a class they are highly volatile and relatively nontoxic (Ex. 2, p. 28). Some do induce cardiac arrhythmias and sensitize the heart to epinephrine-induced arrhythmias (R. 11, Ex. 1A, 1D).

1,1,1-TRICHLOROETHANE

Data exists concerning the effect of methyl chloroform on animals and humans in occupational exposure (R. 12, 102, Ex. 1A, 1E, Ex. 2, p. 27). Among the effects are central nervous system depression, liver damage, nausea, hypotension and decrease in heart rate (R. 12, 1013). It is a confirmed animal carcinogen (R. 209, 1031, Ex. 3A). It is weakly mutagenic in some assays (R. 1014).

TRICHLOROTRIFLUOROETHANE

Trichlorotrifluoroethane causes cardiovascular effects similar to those described under the generic description of chlorinated fluorocarbons above (R. 139, Ex. 1A, 1C, 1D, Ex. 2, p. 28).

TETRACHLOROETHENE

Perchloroethylene damages the liver, kidneys and central nervous system (R. 1013, Ex. 1A, Ex. 2, p. 23). It is fetotoxic, teratogenic, mutagenic and a confirmed animal carcinogen (R. 14, 101, 1014, 1031, 1050, Ex. 1A). However, widespread use in dry cleaning, as an industrial chemical and in drugs indicates that some level of exposure may be acceptable (R. 1005, 1067).

TRICHLOROETHENE

Trichloroethylene causes central nervous system depression and some liver and kidney damage (R. 14, Ex. 1A, Ex. 2, p. 26). It is mutagenic and a confirmed animal carcinogen (R. 14, 101, 209, 1031, 1050, Ex. 1A, Ex. 3A). However, its widespread use in drugs, foods and industrial operations indicates that some level of exposure may be acceptable (R. 1005, 1012, 1031, 1050 and 1067). It was once allowed in decaffeinated coffee at levels of up to 10 ppm, although the more volatile methylene chloride has now been substituted (R. 1006).

DICHLOROMETHANE

Methylene chloride is a central nervous system depressant which damages the lungs and pulmonary system (R. 11, 88, 106, 117, 1038, 1094, Ex. 1A, 1B, Ex. 2, p. 26). It is reported to cause chloracne (R. 90, 1036). It is metabolized to carbon monoxide, resulting in a decrease in carboxyhemoglobin levels (R. 90, 1036, 1081, 1095, Ex. 1B). It is fetotoxic, teratogenic, mutagenic and a confirmed animal carcinogen (R. 14, 102, 209, 1014, Ex. 3A).

TETRACHLOROMETHANE

Carbon tetrachloride damages the liver, kidneys and central nervous system (Ex. 1A, Ex. 2, p. 27). It is mutagenic and a confirmed animal carcinogen (R. 14, 101, 1013, 1023, 1031, Ex. 1A). However, its past widespread use in drugs and as a pesticide and solvent may indicate that there is an acceptable level of exposure (R. 1004, 1067, 1071, 1073). Some of these uses have been prohibited (R. 1075). There is evidence that it is metabolized and not bioaccumulated, although it is usually detected in body fat (R. 1048, 1081).

TRICHLOROFLUOROMETHANE

Trichlorofluoromethane is a volatile chlorinated fluorocarbon, referred to as "F-11" (R. 119, Ex. 1C). It is relatively nontoxic, but does induce changes in heart rate and respiratory depression (R. 11, Ex. 1A, 1C).

CRITICISM OF TOXICITY

Dr. Raymond D. Harbison testified for Waste Management on the question of toxicity (R. 999). In summary, he testified that the chlorinated compounds are widely distributed such that we are continuously exposed to low levels, and that they have a long history of industrial and commercial use, without any evidence of adverse impact. He testified that there is a threshold below which there are no toxic effects. The levels to which the public could be exposed as a result of landfilling at trace levels are less than the background and below the threshold for toxicity, such that the landfill prohibition would result in no benefits.

In the mid-1970s about 2 billion pounds of five common chlorinated solvents were produced yearly in the United States (R. 1003). Most of this was lost into the environment as a result of use of the compounds (R. 1008). Ambient air concentrations of individual chlorinated compounds range up to 38 micrograms per cubic meter (R. 1007). Some of these compounds may be produced by natural processes (R. 1008).

In addition to industrial production, chlorination of water supplies and wastewater results in production of chlorinated compounds. Drinking water chlorination has been known to produce trihalomethane levels as high as 100 mg/l, although the Board has adopted a standard of 1 mg/l in drinking water supplies in Illinois. Drinking water chlorination results in exposure of the population, and both drinking and wastewater chlorination result in entry of chlorinated compounds into the environment (R. 14, 105, 109, 121, 210, 190, 1032, 1035, 1039, 1047, 1062, 1069, 1073).

At one time chlorinated compounds were widely used in medicines and foods, although many of these uses have been eliminated (R. 1005, 1035, 1075). Traces are commonly found in foods (R. 1035). Human consumption of carbon tetrachloride is estimated at 600 to 900 mg per year (R. 1011).

This exposure results in traces of chlorinated compounds in human body fat (R. 1012, 1048). Levels as high as 68 parts per billion have been reported (R. 1012).

The ubiquity of chlorinated compounds has been asserted as proof that low levels are not harmful. However because these compounds are so widespread, it appears to be impossible to find a control group to really establish that there are no harmful effects. Their widespread occurrence can be cited as proof of the need to limit their emission into the environment.

The background occurrence of chlorinated compounds also poses a limitation on the possible benefits of elimination of sources of exposure. Elimination of sources which are at a concentration lower than the background, and which are not contributing significantly to the background, cannot produce any benefit (R. 1027). It is arguable that even a severe leak in a properly sited landfill could not result in chlorinated compounds in water supplies at levels above that already there (R. 570, 1010). Furthermore, it seems to be evaporative losses during use of solvents which is the major contributor to the background, rather than overt disposal (R. 1008).

Dr. Harbison contends that there is a long record of safe occupational exposure to low levels of chlorinated compounds (R. 1012, 1043, 1067). Although many of the toxic effects discussed above were discovered through occupational exposure, they are based on high levels of exposure.

Animal studies were also based on high levels of exposure. Dr. Harbison is convinced that some of these compounds have a threshold below which there are no effects (R. 1016, 1018, 1037, 1043).

Dr. Ginsburg on the other hand testified that low levels of exposure for a long period of time could produce toxic effects, especially carcinogenic effects (R. 90, 109, 210).

Dr. Harbison testified that there were two mechanisms by which chemicals can induce cancer or mutations: genotoxic carcinogens cause direct damage to the genetic mechanisms; while epigenetic carcinogens induce cancer indirectly by causing recurrent injury to tissues (R. 1020, 1024, 1031, 1049). Although there may be no safe level for exposure to genotoxins, there is a threshold for epigenetic carcinogens. Dr. Harbison testified that the aliphatic chlorinated compounds under consideration were not genotoxins (R. 1021, 1031, 1049). Apparently this does not necessarily hold for the aromatic chlorinated compounds such as chlorobenzene and orthodichlorobenzene (R. 1021, 1031, 1049).

Dr. Harbison also testified that some of the low molecular weigh aliphatic chlorinated hydrocarbons are metabolized and excreted with a reasonably short half life. They are not accumulated in fat, although the body's current burden is found there (R. 1036, 1048, 1095).

In summary, it appears that the chlorinated compounds are without doubt toxic, although, for some of them the toxicity at low levels and tendency to bioaccumulate is doubtful. Based on toxicity alone, they should be given a lower priority in order of banning than other wastes such as cyanide (R. 1080). However, they clearly are not desirable constituents of potential sources of groundwater. They clearly pose a sufficient risk to warrant limitations on landfilling based on toxicity alone.

Dr. Harbison stated his opposition to the landfilling of liquids, and recommended establishment of concentration levels of 1 to 5% chlorinated compounds (R. 1058, 1068, 1071, 1081, 1090). The 1% levels proposed by the Board are within this range.

EFFECT ON LINERS

In addition to their ultimate toxic effects if they enter groundwater, chlorinated compounds pose a threat to landfill liners. Should the liner fail, toxic materials in leachate could escape, the halogenated compounds as well as any other materials (R. 501).

Landfill liners have traditionally been made of compacted clay; the RCRA rules now essentially require a synthetic liner, since they prohibit entry of waste into the liner during the active life of the cell. Waste would be expected to penetrate at least a small distance into clay during the active life (R. 441)[Section 724.401(a)(1)]. The RCRA rules allow leakage of the liner after closure. Groundwater is to be protected by: construction and maintenance of a cap and run-on controls to prevent entry of water into the closed landfill; by operation of a leachate collection and removal system to prevent development of a sufficient head to force leachate through the liner; and, groundwater monitoring or monitoring of a leak detection system (R. 442, 1108, 1118, 1120, 1139, 1142).

Although future hazardous waste landfills will place primary reliance on synthetic liners, many will continue to rely on clay for secondary protection against leaks. Landfills will usually be constructed on a clay bed (R. 445). It is possible that the RCRA rules may be construed to allow use of clay as the bottom liner in a double lined landfill (R. 445). Furthermore, although synthetic liners are less permeable than clay, it is likely that their service life is limited to a few decades (R. 442, 484, 489, 1152). After the synthetic liner fails, clay will be necessary to attenuate any leachate movement (R. 445).

The primary threat to either clay or synthetic liners comes from organic solvents present as a non-aqueous liquid phase (R. 470, 517, 526, 867, 882, 890, 902). Such phases may include, or be composed entirely of, organic solvents. The relative proportions of water and organic phase present is irrelevant, since the phase will either float or sink in the aqueous environment of the landfill, and come into contact with the liner either on the bottom or side of the landfill (R. 76, 94, 871, 877, 884, 899, 1153).

Organic solvents can cause a change in the structure of clay, through desiccation and shrinkage, which results in cracks through which liquids can flow. Permeability increases by several orders of magnitude (R. 866, 890). Some clays show a reduction in permeability when they are rehydrated, although they never regain their original degree of impermeability (R. 873).

Organic solvents also degrade synthetic liners through a variety of mechanisms, including actual dissolution of the liner, swelling and reduction in tensile strength, making the liner more susceptible to failure due to stresses (R. 470). The experts who testified were in agreement that solvents should not be placed into landfills, both because of the impact on liners and because they are liquids (R. 517, 526, 882, 888, 1090). Sections 729.240 and 729.242 prohibit wastes containing non-aqueous liquid phases which are halogenated solvents.

Halogenated compounds may also be present dissolved in an aqueous phase. Most of them are soluble in pure water at levels of around 100 to 1000 mg/l, with methyl chloroform soluble at around 4400 mg/l, and dichloromethane at 20,000 mg/l (Ex. 1, 2; R. 524). However, they could be far more soluble in an aqueous phase containing other organic solvents, such as methyl alcohol (R. 1154).

Dr. Kirk W. Brown testified that phases which are more than 50% water have no impact on clay liners (R. 899, 901). Since this corresponds with the definition of "aqueous phase", he saw no need to establish any concentration levels for halogenated solvents in aqueous phases (R. 902).

Mr. Phillip E. Antommarie testified concerning tests run with actual and simulated leachates using triaxial stands, which more closely approximate conditions of an in-place clay liner (R. 1111, 1153). The actual leachates were on the order of 3 mg/l organics, and the simulated 1000 mg/l trichloroethylene and trichloroethane (R. 1115, 1153). These produced no changes in permeability (R. 1113). Mr. Antommarie stated that there was no problem with landfilling wastes which are 1% to 2% solvent in existing landfills (R. 1145).

Mr. John C. Petura testified that halogenated solvents present in aqueous phases at levels of more than 1%, or 10,000 mg/l, posed a threat to synthetic liners (R. 482, 512, 514, 521, 525, 533, 535). This level was based on his experience with the use of synthetic liners in treating wastewater from chemical plants (R. 533, 535). In Section 729.241 the Board has established a concentration limit of about 1% halogenated compounds in aqueous phases, based in part on this testimony.

OTHER ADVERSE IMPACTS OF LANDFILLING LIQUIDS

Many wastes containing halogenated compounds are liquids or contain free liquids. The proposed bans center on the potential for forming an organic liquid phase, and to a lesser degree on aqueous liquid phases; solids which do not form an organic liquid phase may be landfilled under this proposal. There are considerations supporting the ban on the liquid wastes besides the threat of liner deterioration.

Liquid wastes may become mobile in a landfill; they may be able to dissolve toxic substances from solid wastes through which they pass (R. 132, 1082). If the liquid is a non-aqueous phase, it would be expected to dissolve a range of toxic materials very different from the water, which may be unavoidable during the active life.

Success of the RCRA landfill design depends largely on establishment of a cap which is less permeable than the bottom liner and on leachate collection and removal (R. 337, 442, 1118, 1120, 1139, 1142). The idea is to establish dry conditions inside the completed landfill. Landfilling liquids would cause two problems. First, movement of the liquids could create voids, resulting in a subsidence, possibly damaging the liner in the cap, and thus allowing surface water to enter (R. 1133, 1156). Second, all of the liquids are expected to eventually move into the leachate collection system, from which they will be pumped to the surface for treatment. It seems as if it would be a lot cheaper in the long run to treat them before landfilling (R. 1090). These considerations have been addressed through the RCRA ban, and through the Illinois statutory ban on landfilling liquid hazardous waste.

PERSISTENCE

In a completed landfill the liner and wastes are buried and not accessible to direct inspection. As is noted elsewhere, the RCRA landfill design provides for a cap, leachate collection and removal and groundwater monitoring. The strategy is to dewater the contents of the landfill and protect against entry by other water. Groundwater monitoring is to be conducted to provide early detection against leaks (R. 557).

The RCRA design is new and yet untested. In Illinois, chlorinated compounds have been found in monitoring wells at two older landfills, Wilsonville and Sheffield (R. 85, 212, Ex. 3, 4). Chlorinated solvents leaking from lagoons at the Amoco facility in Wood River have also been detected in groundwater (R. 1105, 1151).

If leaks are detected it is possible to carry out various operations to repair the liner (R. 492, 509). However, this would not be as good as an original installation (R. 510). It certainly would increase the cost of disposal greatly.

Chlorinated compounds are generally very resistent to decomposition; indeed, this is one of their desirable properties as industrial solvents. However, there is some indication that they decompose due to bacterial action under anaerobic conditions, especially when in contact with soil and general refuse (R. 1116, 1121, 1125, 1127, 1129, 1136, 1140). Such decomposition is not thought to take place in containers of solvents (R. 1131, 1140). These results may not prove applicable to the RCRA landfill with its segregation of wastes and dry conditions (R. 1130).

Even with these reassurances, it seems likely that placement of wastes containing chlorinated compounds in landfills poses a threat of groundwater contamination, not only from chlorinated compounds, but also from any other wastes present should the liner be breached (R. 501). If these contaminants enter groundwater, expensive repair of the liner will be required. There will have to be more expensive groundwater monitoring and possible active cleanup if dilution and dispersion are insufficient to protect aquifers (R. 570).

Recycling and treatment operations also may pose a threat of groundwater contamination: storage and transfer operations can result in solvent spills (R. 547, 562). However, these activities are subject to inspection under the RCRA permit program. It should be possible to detect such poor operating practices more quickly than a leaking, buried liner. Cleanup costs for a surface spill should be far less.

ALTERNATIVE DISPOSAL OR RECYCLING

The alternatives to landfilling of wastes containing halogenated compounds depend on what combination of the following the waste includes: a non-aqueous halogenated solvent phase; an aqueous phase; or, a solid phase. The phases can be separated by settling, filtration or centrifugation (R. 194, 205, 410, 737, 769, 773, 983, Ex. 2, p. 3, 7, 22, 39).

If an halogenated solvent phase can be separated from the waste, recovery of the solvent is attractive. It may be possible to recover a useful solvent after just sedimentation or filtration; distillation may be required if the solvent components must be separated before reuse. However, separation by distillation may not be feasible if boiling points are too close together (Ex. 2, p. 8, R. 194, 205, 718, 778). Distillation produces "still bottoms", a residue which requires further treatment or disposal (Ex. 2, p. 39, R. 765). As is noted below, there is an established solvent recycling industry in Illinois which has abundant excess capacity to recycle all of the halogenated solvents which are capable of being recycled.

Incineration of solvent phases depends on the amount of halogen present in the solvent. Generally, the more halogen present in a given compound, the less heat produced by combustion. Of the halogenated compounds listed in Section 729.221, only chlorobenzene and orthodichlorobenzene would be able to sustain combustion if burned alone (R. 723, 746, Ex. 1A). The rest would require the use of expensive auxiliary fuel to achieve combustion (R. 726, 735; PC 8). However, if the halogenated solvent were present at low concentrations in another solvent, the solution would be easy to incinerate, and possibly be usable as a fuel (R. 768).

There are several drawbacks to incineration. Temperatures must be maintained at above 2200° F to obtain the 99.99% destruction removal efficiency for halogenated compounds as principal organic hazardous constituents required by Section 724.443 (R. 729, 735). The halogenated compounds are converted to hydrogen chloride, which must be removed by a scrubber if emitted in excessive quantities (Section 724.443).

Improper combustion can also produce dioxins, especially combustion of chlorinated aromatic solvents (R. 730, 740, 742). Dioxin formation may be caused by improper temperature or mixing during combustion (R. 742). Dioxins are expected to adhere to particulates and be removable by scrubbers (R. 83, 99, 267).

Wastes may contain metals, such as mercury or nickel. Mercury is gaseous at incinerator temperatures, and both mercury and nickel are capable of forming gaseous compounds. These would be converted to particulates under conditions in the incinerator or scrubber, and would be removed by the scrubber as particulates (R. 36, 72, 134, 184, 230).

Scrubbers produce sludges which may themselves be hazardous wastes. Incineration also produces ash, which also could be hazardous. Incineration is not a disposal of the waste, but is a treatment which reduces the waste in volume and possibly makes it less hazardous (R. 83, 99, 178, 267, 728, 758, Ex. 2, p. 12). The principal problem cited with scrubber sludges is their calcium or sodium chloride content, which is very leachable (R. 728).

Use of waste solvents as fuels is referred to as "coincineration" (R. 177, Ex. 2, p. 12, 57). The halogen content of a solvent waste limits its use as a fuel because of factors other than the reduction in caloric content. The hydrogen chloride from combustion of chlorinated solvents forms hydrochloric acid in water. Because this can attack boiler tubes, only solvents with low halogen content are useful in boiler fuels (R. 723, 765). Cement kilns can burn fuels up to 3% halogen, but beyond that excess calcium chloride is formed in the product (R.24, 760, 763, Ex. 1).

Halogenated compounds in solvent phase may also be absorbed into a solid or fixed into a solid matrix (Ex. 2, p. 16). As is discussed elsewhere, the Board is proposing to prohibit the use of absorbent materials to comply with the halogenated solvents ban.

Incineration of solvent phases requires a liquid injection incinerator. Both the Waste Management incinerator at Sauget and the SCA incinerator near Chicago appear to be able to handle these wastes (R. 732, Ex. 2, p. 40). There are also incinerators in Ohio, New Jersey, Texas, Georgia and Kentucky (R. 754). There appears to be adequate capacity to incinerate all solvent wastes which are not suitable for recycling or use as fuel (R. 735, 953).

Mr. Richard P. Ross, testifying for Waste Management concerning incinerators, stated his support for prohibition of landfilling of pure halogenated materials, and indicated that dilute solutions in solvent phases were easier to incinerate and more suitable as fuels than pure halogenated solvents (R. 716, 735, 768).

Alternative treatment or disposal of aqueous wastes poses different problems. It is not likely that halogenated compounds would be present in an aqueous phase in sufficient quantities to allow recovery of the solvents through distillation (R. 718). The aqueous solutions will require some sort of treatment prior to disposal.

The difficulty with incineration is the presence of water in the aqueous wastes. As defined in Section 729.220, an "aqueous phase" has water as the solvent, comprising more than 50% of the phase. A large amount of auxiliary heat is required to vaporize the water to achieve combustion of the halogenated solvents (R. 720, 726, 737). As noted elsewhere, the halogenated compounds to be regulated are soluble in pure water to an extent of less than 2%, so that almost all of the phase would likely be water and polar solvents. Any polar solvents would contribute as fuel to support combustion, but the 50% maximum in aqueous phases would be below the level required for easy incineration (R. 770).

The necessity for auxiliary fuel to evaporate water increases the cost of incineration to above that for the same mass of halogenated compounds in the absence of water. It also requires more incinerator capacity, since incinerators are limited more by thermal capacity rather than the mass put through them to be destroyed (R. 719, 733, 745). Mr. Ross estimated that up to four times the capacity would be required to incinerate aqueous wastes in excess of one part per million than would be required to incinerate those in excess of 1% (R. 748). He recommended the 1% level as a reasonable cut-off in terms of the amount which would have to be incinerated (R. 736, 748). This happens to be the level chosen by the Board in Section 729.241, based on the impact on synthetic liners.

Aqueous solutions are useless as fuels. Cement kilns cannot burn aqueous solutions (R. 762).

Deep well injection is available for disposal of dilute aqueous solutions of chlorinated solvents (Ex. 2, p. 15). The Board has adopted regulations which have allowed Illinois to obtain primacy for its underground injection control program (_ Fed. Reg. ____). Availability of permits should remove a major obstacle to use of this alternative, while assuring a complete review of dangers associated with injection. Cost of operation of injection wells is very low (Ex. 2, p. 16). There is one existing well in Illinois which injects pesticide residues, but not chlorinated solvents (Ex. 2, p. 41).

Other possibilities include wet oxidation and supercritical water reforming (Ex. 2, p. 14, Ex. 12, 13, R. 177, 359). These do not appear to be available.

Dilute solutions of halogenated compounds are dealt with in wastewater treatment through air stripping and carbon adsorption (Ex. 2, p. 13; Ex. 14, p. 22, App. VIII, p. 103, PC 7). The former technique involves aeration of the wastewater with the halogenated compounds escaping in the atmosphere. There is some degradation of the environment associated with this technique. Carbon adsorption is a recognized technique both for treating wastewater and drinking water. The record is insufficient to form definite conclusions concerning the practicality of these methods as applied to aqueous wastes.

The final category of wastes is solids, which for purposes of this discussion includes "liquids", as defined in Section 729.220, with solid phases which limit the recycling or incineration of the waste. Such wastes identified in this rulemaking include filter cartridges from dry cleaners, still bottoms from solvent recycling and spill residues (R. 177, Ex. 2, p. 8). It may be possible to separate the liquid phases from such wastes for recycling, treatment or disposal as discussed above. It is unlikely that any solvent could be recovered for recycling apart from that which could be physically separated from the waste.

Incineration of solid hazardous wastes requires different equipment than liquid injection incineration. The two incinerators in Illinois have this equipment. The Waste Management incinerator at Sauget is suitable for "fairly dry solid materials", but not for certain types of sludges (R. 733, Ex. 2, p. 40). It is "very small" (R. 753). The SCA incinerator could handle about 4 to 6 tons per hour of solid waste (R. 734, Ex. 2, p. 40). The combined capacity could not handle contaminated soil from a large spill or the clean-up of any major abandoned site (R. 744).

ECONOMIC IMPACT

Determination of the economic impact of the proposal involves a comparison of its costs and benefits. Most of the discussion has centered on estimating the direct costs to the persons subject to the proposal. Estimation of these costs depends on the following factors:

1. Definition of the waste to be prohibited;
2. Determination of the quantity of waste generated;
3. Identification of the waste generators;
4. Identification of the present methods of recycling, treatment or disposal;
5. Identification of the current disposal methods which would be prohibited, and the quantities and costs associated with the prohibited disposal methods;

6. Identification of alternative recycling, treatment and disposal techniques;

7. Determination of the costs associated with the alternative techniques;

8. Determination of the quantities amenable to alternative techniques;

9. Comparison of the current costs with the projected costs under the proposal.

Dames and Moore prepared an economic impact study of the proposal for the Department of Energy and Natural Resources (Ex. 2). Two hearings were held on the economic impact as required by Section 27(b) of the Act. A number of questions were raised concerning the way the projected costs were addressed in the study. At the hearings following the first notice Order, Waste Management presented additional testimony concerning a number of these points (R. 923).

Waste Management contends in part that the rulemaking is defective because of a deficient economic impact study (R. 955, 971, 981). This is a misreading of Section 27(b) of the Act, which requires that the Board conduct hearings on the study, receive public comments on it, consider the elements detailed in it and make a determination "based upon the"...(Department's)..."study and other evidence in the public hearing record, as to whether the proposed regulation has any adverse economic impact..." There is no language authorizing the Board to dismiss a rulemaking proposal from the public because of the deficiency of a study. The purpose of the hearing is for the affected industries to bring any deficiencies to the Board's attention. Waste Management should have made its complaints known at the economic impact hearing. The Board has furthermore provided additional hearings in which Waste Management has been allowed to present testimony on the economic impact.

Waste Management also contends that the Board increased the scope of the rulemaking beyond the CBE proposal at the time of the first notice order by specifying one part per million as a definition of trace levels. On the contrary, the original CBE proposal was for a more sweeping ban, which the Board pruned back in its first notice Order (R. 957). Although Waste Management may have understood the F001 and F002 wastes defined in Part 721 to have an implied 1% concentration rule, it made no attempt to introduce this fact at the first series of merit and economic impact hearings at which the concentration levels were discussed (R.199, 201, 278, 981).

Section 27(b) of the Act allows the Board to modify and subsequently adopt any proposed regulations without any additional economic study by the Department of Energy and Natural Resources provided such amendment does not significantly alter the intent and purpose of the proposed regulation which was the subject of the study.

The definition of the wastes to be prohibited has been subject to some confusion. The CBE proposal was couched in terms of generic wastes F001 and F002. The first notice proposal dropped the reference to F001 and F002, but listed the compounds comprising those wastes, and set a definite limit on trace levels of one part per million. Although many experts agreed that it was desirable to set some definite de minimis limit (R. 736, 808, 944), this created problems in two areas: first, it is conceivable that a waste containing an halogenated compound at 1 ppm might not be a hazardous waste (R. 940, 968, 975); and, second, generic wastes F001 and F002, as applied, seem to have an understood 1% limit (R. 199, 201, 943, 957, 979). The Board has modified the proposal by restricting Part 729 to hazardous wastes, and has changed the concentration rules to 1%, so that the definition of the wastes to be prohibited is closer to that apparently used in the economic impact study and other studies quoted by Waste Management.

The proposal regulates waste according to whether it includes a non-aqueous liquid phase, or whether it is an aqueous phase or a solid. The economic impact study, emphasizing recycling potential, classified waste as "liquid-high solvent content, liquid-aqueous solution and sludge/high solids solvent content" (R. 185, 196, Ex. 2, p. 22). This classification is related to the terms used in the proposal, but the terms cannot be equated.

Determination of the quantity of waste generated is also subject to difficulties. The estimates are derived from Agency data which must be interpreted to relate to this proposal. The following problems have been pointed out:

1. The definition of "hazardous waste" has changed since data collection started.

2. As noted, the definition of generic wastes F001 and F002 may be subject to varying interpretations with respect to a de minimis quantity of halogenated compounds (R. 199, 201, 943, 957, 979).

3. Agency data was collected with respect to special waste, a broader category than hazardous waste (R. 931, 934).

4. Agency data is based on definitions of wastes used in supplemental wastestream permits which utilized a 1% criterion for halogenated waste (R. 977, 959).

5. Agency data is derived from manifests and may not include unmanifested waste movements, such as on-site disposal or illegal movements (R. 927, 932, 935, 974).

6. Quantities of waste imported into the State may not be adequately counted (R. 935).

7. The data shows a 71% reduction in chlorinated wastes over a three year period, which may be unbelievably large (R. 176, 200, 940, Ex. 2, p. 18).

8. The data must be corrected for changes in the level of economic activity which is directly related to the quantity of waste produced (R. 200, 932, Ex. 2, p. 52).

The economic impact study did not directly address the quantity of waste generated, but based its cost estimates only on the quantity landfilled (Ex. 2, p. 52). Mr. Michael P. Mauzy, testifying for Waste Management, estimated that about 2.9 million gallons per year of chlorinated wastes were generated in Illinois for off-site disposal (R. 940, Ex. 32, Table IV). His estimate may be too high because of his broader definition of chlorinated wastes, which includes pesticide residues, and because of his broad interpretations of the first notice proposal. The estimates would be lowered now because of changes since the first first notice.

Generators of chlorinated solvent wastes include persons using the solvents and persons engaged in recycling of the spent solvents. Solvents are widely used in dry cleaning and in industry for metal degreasing (Ex. 2, p. 7, 52). The economic impact study estimated that there are about 930 generators (R. 951, Ex. 2, p. 20, 53).

The generator totals do not include all dry cleaners since there are about 1400 in the State (R. 295). Dry cleaners may be inadequately represented in the Agency data because they often operate outside the manifest and supplemental permit systems (R. 292). They do not appear to be subject to any exemptions to the rules requiring manifests and supplemental permits.

Determination of the number of generators affected also depends on whether on-site disposal is included in the ban, and whether other forms of disposal amounting to landfilling are included. On-site storage and disposal units have long been exempt from the State permit requirement now in Section 21(d) of the Act, and may not be adequately addressed in the Agency data. Mr. Mauzy testified that about 73% of the volume of special waste produced in the State is disposed of on the site of generation (R. 932). If this percentage holds for the chlorinated solvents, the quantity of waste affected could be quadrupled by inclusion of on-site disposal. Mr. Mauzy was of the opinion that the quantities in the economic impact study did not include on-site disposal, which is not included in the Agency data (R. 927, 933).

Another problem relates to the inclusion in the ban of surface impoundments and waste piles if waste residues are expected to remain after closure. Mr. Mauzy testified that over 7000 impoundments at over 5000 facilities were inventoried by the Agency in 1978 and 1979 (R. 949). Although there is no indication of what fraction of these involve chlorinated solvents, the number of generators impacted, and the quantity of waste produced, could be far larger than estimated in the study.

The CBE proposal to the Board used the term "sanitary landfill" to effectuate the ban. As defined in Section 3 of the Act this includes RCRA facilities. The RCRA rules contain no exemption for on-site disposal, and treat surface impoundments and waste piles as landfills if waste residues are expected to remain after closure (Sections 724.328 and 724.358).

As noted above, the traditional methods for recycling, treatment or disposal of chlorinated solvent wastes include the following:

1. Mixed wastes:
    a. Direct landfilling;
    b. Landfilling after fixation or treatment with absorbent;
    c. Thermal treatment in a rotary kiln incinerator;
    d. Mechanical separation with different recycling, treatment or disposal for each phase, as is discussed below.

2. Solvent phases:
    a. Recovery of solvents through distillation, with separate treatment or disposal of still bottoms;
    b. Direct landfilling;
    c. Landfilling after fixation or treatment with absorbent;
    d. Incineration in a liquid injection or other type of incineration;
    e. Coincineration;
    f. Other treatment and disposal listed for aqueous wastes.
3. Aqueous phases:
    a. Incineration in a liquid injection or other type of incinerator;
    b. Direct landfilling;
    c. Landfilling after fixation or treatment with absorbent;
    d. Deep well injection;
    e. Wet oxidation or supercritical water reforming;
    f. Air stripping;
    g. Carbon adsorption.
4. Solid wastes:
    a. Direct landfilling;
    b. Incineration in rotary kiln incinerator.

The economic impact study found the following costs associated with techniques for recycling, treatment and disposal:

	Cost Per 55 gal. drum	Ex. 2
Landfilling	$30 to $40	p. 36
Incineration	$40 to $194	p. 42
Coincineration	$23 to $600	p. 13
Deep well injection	$4.40 to $7.70	p. 16
Recycling (savings)	($27) to ($30.50)	p. 42, 57
Wet oxidation	$77	p. 14
Supercritical Water Reforming	$5.50 to $16	p. 15

The existing bans in the RCRA rules and the coming statutory bans on landfilling liquid hazardous wastes have or will curtail the direct landfilling of the liquid wastes and the mixed wastes containing free liquid. Therefore these should be removed from the list of disposal methods to arrive at the allowable methods prior to implementation of the proposal.

As is noted elsewhere, the impact of the proposal in addition to the existing RCRA and pending statutory bans will be to prohibit the addition of absorbents to solvent phases and to prohibit the landfilling of solid wastes which form a non-aqueous liquid phase when mixed with water. The costs associated with prohibition of direct landfilling of liquid hazardous wastes are now more properly attributable to the RCRA rules and the statutory ban.

These broader bans have greatly reduced the impact of the proposal from that which was perceived when the CBE proposal was filed with the Board, and when the earlier hearings were held. It is impossible to determine from this record exactly what quantities of additional wastes will be banned. Caterpillar Tractor Co. has indicated that its wastewater treatment sludge is a solid which may release a non-aqueous liquid phase when mixed with water (PC 11).

Because of the factors noted above, the number of generators and the quantity of chlorinated solvent waste produced in the State may have been greatly underestimated in the economic impact study. On the other hand, the impact in excess of impact of the RCRA and statutory bans may be much less. It is not possible to arrive at specific dollar amounts that take into consideration these factors. Since they tend to cancel out, the cost estimates from the economic impact study may be close to reality.

The study estimated that landfilling of 124,000 to 410,000 gallons of wastes would be prohibited, depending on whether 1982 or 1980 is chosen as the base year. The present cost of landfilling at $40 per drum is between $90,000 and $300,000 per year. Based on recycling 20% of this volume and incinerating the rest, at a cost of $194 per drum, the cost would be $340,000 to $1,130,000, allowing for savings from the recycling and incinerating recycling residues (Ex. 2, p. 58). The cost in excess of landfilling is between $250,000 and $830,000.

Benefits include protection of the public from groundwater contamination. The recycling and incinerator industries will benefit from increased utilization of their existing capacity. Generators may benefit indirectly from reduced liability for clean-ups should liners fail. State government may benefit from not having to monitor chlorinated solvents and having a simpler rule to enforce.

The benefits to the public from improved water quality, and the potential costs to generators of a cleanup, are too speculative for estimation. The increased disposal costs to generators, and lost revenues to landfills, are simply increased revenues to the recyclers and incinerators. In addition, transporters will gain some $1,500 to $5,000 from increased waste movements. State agencies may save some $48,000 per year, which will be partially offset by some $1,240 in lost landfill hazardous waste fees (R. 180, 189).

PROPOSED ACTION

The Board has modified the proposal in response to comments and the public hearings. The following is a discussion of the proposed rules, which appear in a separate Order:

Section 729.100 Purpose, Scope and Applicability

Paragraphs (a) through (e) follow the CBE proposal almost verbatim. A second sentence has been added to paragraph (b) to make it clear that "landfills" includes hazardous waste landfills with RCRA permits (R. 242). "Landfills" also includes surface impoundments and waste piles in which waste residues are expected to remain after closure.

The rule prohibits disposal in landfills. This is to be taken as equivalent to "land disposal" in 35 Ill. Adm. Code 724, under which lagoons and waste piles in which wastes will remain after closure are to be treated as landfills [R82-19, 7 Ill. Reg. 14015, October 28, 1983; Sections 724.210(b)(2), 724.328(a)(1) and 724.358(a)].

The other "disposal" methods are considered to be treatment or storage under the RCRA rules. The Board intends to promote thermal treatment such as incineration. Bona fide treatment or storage in lagoons or, to the extent possible, in piles is not prohibited. Land treatment is likewise not prohibited, although the operator would have to demonstrate that the hazardous constituents would be "degraded, transformed or immobilized" (35 Ill. Adm. Code 724.372). Underground injection pursuant to UIC permit will also be allowed (35 Ill. Adm. Code 704 and 730, 6 Ill. Reg. 12,479).

Paragraphs (c) and (d) elaborate on the relationship to the RCRA rules: landfill prohibitions do apply even to RCRA small quantity generators, but do not apply to residues in containers or empty liners which would not be hazardous wastes under the RCRA rules (R. 152, 158, 262).

Paragraph (e) states the intent to supplement Parts 807, 809 and the RCRA disposal rules in Parts 724 and 725. Regulations in those Parts which could be construed as authorizing prohibited landfilling are superseded. The relationship to Part 807 is elaborated on in Section 729.122.

Paragraph (f) has been added to the CBE proposal. This makes it clear that the Board intends that the landfill ban be applicable not only to landfill operators, but also to the generators and transporters of the waste (R. 247).

Section 22(h) authorizes: "requirements to prohibit the disposal of certain hazardous wastes in sanitary landfills." Taking the words in their ordinary meaning, the generator and transporter are disposing of the waste by sending it to a landfill.

From a practical standpoint it is necessary to regulate generators and transporters directly. It would not be economically feasible for landfill operators to inspect every load coming into the landfill. There would be no incentive for generators and transporters to keep prohibited wastes out of landfills if the only penalty were rejection of an occasional load which was detected. On the other hand, the generator has actual control over his disposal practices, and the transporter has the opportunity to inspect every item before loading it.

Paragraph (f) leads into the next two related Sections which deal with a complete and partial defense which could be used by the transporter and disposer.

Section 729.120 Generators Assertion of Exemption

The transporter and disposer may insist on a written statement of compliance from a generator. Section 729.120 allows introduction of such a complete defense in an enforcement action, except where knowledge is shown. Such a written statement would be used as documentary evidence against the generator, and could be evidence of intentional violation.

The generator exemptions are keyed to the quantity of waste generated rather than the quantity landfilled. The transporter cannot simply weigh the monthly loads to satisfy himself that the generator is in fact in compliance, since the generator could be utilizing another means to dispose of part of the waste. Section 729.120 allows the transporter to rely on a written statement asserting exemption. Of course, if the transporter were actually transporting waste in excess of the exempted quantity allowed the generator, he would be held to have known that the waste's disposal was prohibited.

Section 729.121 Mitigation

This establishes a partial defense under Section 33(c) of the Act. A person who conducts employee training, posts signs and conducts random sampling of wastes should not have a substantial penalty levied against him in the absence of other aggravating circumstances.

Section 729.122 Relationship to Wastestream Permits

The Board notes that Section 39(h) was added to the Act by different legislation than Section 22(h). It requires, after 1986, individual authorization of hazardous wastestreams by the Agency (R. 146). It is beyond question that the Agency could not approve a wastestream which has been banned by the Board.

Paragraph (c) deals with the details of Agency review of wastestreams. The Agency may require the applicant to demonstrate that halogenated compounds are present at less than specified levels or that an exemption applies. The Agency is expected to reach a decision on the applicability of Part 729: it is not to issue the wastestream authorization with a caveat that Part 729 may apply.

The Agency's review of wastestreams which are routinely generated is to focus on the average quantities and properties of the waste. It may establish conditions necessary to assure continued approval under Part 729. However, conditions which would allow landfilling some months and prohibit it in others are to be avoided. These would frustrate long-term planning.

A wastestream authorization should identify the waste by composition with a range of acceptable variation. Once the wastestream has been authorized for landfilling, Part 729 will be superseded by the conditions of the authorization. The main limitation on this is the description of the wastestream. If this gets outside the parameters which identify it, a new authorization will be needed (R. 246).

Section 729.123 Waste Analysis

The Board does not intend to specify analytical techniques to be used to identify wastes coming into landfills. For wastes which are routinely generated, what is intended is rules which the Agency is to apply in issuing supplemental wastestream permits or authorizations. Whether an applicant has demonstrated that a waste has certain characteristics is a question of fact to be determined from all the evidence presented with the application. Tests and frequency of testing for individual waste loads are to be specified in the supplemental wastestream authorizations and the waste analysis plan for a RCRA facility (Section 724.113). The operator may use any techniques which he demonstrates to have a reasonable relationship to the property to be measured (R. 789, 792, 800, 842).

Section 729.140 Variances and Site Specific Regulations

The provisions of the Act and Procedural Rules governing variances and site specific regulations apply to all Board rules. However, the Board has added a specific reference to the proposal since applicability of these procedures seems to have caused confusion (R. 367, 395, 423).

Section 729.200 Purpose, Scope and Applicability

This Section introduces the Subpart dealing with the halogenated solvent ban. Provisions which are expected to be equally applicable to future bans have been placed in Subpart A, while those applicable only to halogenated solvents have been placed in Subpart B.

Section 729.201 No Circumvention

Paragraph (a) prohibits the mixing of wastes, or the dilution of a waste with another material, in order to evade the landfilling prohibitions of this Part. Thus it would be unlawful to mix a concentrated solvent waste with a dilute waste to lower the concentration to meet concentration limits.

This paragraph is not intended to prevent mixing which is a necessary part of a process. What is prohibited is unnecessary mixing or intentional mixing to avoid application of this Subpart. These rules are intended to apply both to the mixing of waste with waste and to the addition of other material to waste (R. 255, 265).

The first proposal included a paragraph providing for recomputation of concentrations to correct for improper mixing or dilution. This has been dropped. It will therefore be legal to landfill a waste resulting from a violation of paragraph (a), although the mixing or dilution itself could form the basis of an enforcement action.

The first proposal included concentration limits on halogenated organics in solids. Since these have been dropped, the dilution rule of paragraph (a) would no longer operate to prohibit addition of absorbent material. The Board has therefore added a specific prohibition on addition of absorbents.

The RCRA rules contain express provisions authorizing addition of absorbent material to liquid wastes and disposal of "lab packs" in drums of absorbent. The Board's intent is to prohibit such practices in the case of halogenated solvents if the waste is to be landfilled in Illinois (R. 95, 123, 261).

Paragraph (c) attributes transferred waste to the "last person who used the solvent." A straw party who holds another's waste cannot take advantage of a separate small quantity exemption. Because such transfers could be for bona fide purposes, there is no direct proscription. However, the generator could be charged with a violation for exceeding quantity limits.

Section 729.202 Incorporations by Reference

The Board has incorporated two ASTM methods for determining total organic halogen, and the proposed paint filter test to determine whether free liquids are present. The latter will be used pending completion of R83-28.

Section 729.221 Definition of Halogenated Compound

Halogenated compounds include the chlorinated compounds in generic hazardous wastes F001 and F002 in 35 Ill. Adm. Code 721.133(f): carbon tetrachloride, chlorinated fluorocarbons, chlorobenzene, 1,2-dichlorobenzene, methylene chloride, perchloroethylene, 1,1,1-trichloroethane, trichloroethylene, trichlorofluoromethane and 1,1,2-trichloro-1,2,2-trifluoroethane.

Alternative names for many of these chemicals have been listed. Some chlorinated fluorocarbons have been specifically listed (R. 114). Physical properties and alternate names are summarized in Table I.

The CBE proposal was framed in terms of generic wastes F001 and F002. The first is solvents used in degreasing, including still bottoms from recovery of these solvents. The second is other chlorinated solvents in general. At the hearings it became apparent that F002 is a catch-all which would include wastes containing solvent residues from any source. Accordingly, the proposal has been rephrased without special reference to solvents used in degreasing apart from other solvents. This also makes it clear that the result of any treatment process is to be tested against the same standard as any other waste to determine whether it contains halogenated compounds (R. 76, 99, 243, 267, 274, 957, 979).

The listings are "halogenated compounds": if they are present in an organic solvent above a certain level, the solvent will be an "halogenated solvent" (§729.222) subject to prohibition (§§729.240 and 729.242); if they are present in an aqueous phase, the waste is subject to prohibition under §729.241. Use of the word "compound" with the listings allows one to define "halogenated solvent" in terms of its properties as a solvent and the presence of halogenated "compounds", without having to introduce unnecessary confusion from previous use of the word "solvent" in the listing. It also avoids using the word "solvent" to refer to trace levels in water which, although they often result from use of a solvent, are now a solute.

Section 729.222 Halogenated Solvent--Definition

The term "halogenated solvent" has been defined as a non-aqueous liquid phase containing more than 1.4% of the halogenated compounds listed in Section 729.221. The concentration is to be determined from the aggregation of the weights of the compounds present and the weight of the sample.

TABLE I

		[2] Solubility mg/kg in water	[1,2] b.p. °C
B010	benzene, chloro- phenyl chloride C_6H_5Cl	500	131
B020	benzene, 1,2-dichloro- orthodichlorobenzene $C_6H_4Cl_2$	100	179
B030	chlorinated fluorocarbons	--	--
B040	ethane, 1,1,1-trichloro- methyl chloroform CCl_3CH_3	[4] 4,400 650	74
B050	ethane, 1,1,2-trichloro-1,2,2-trifluoro- CCl_2FCClF_2	--	48
B060	ethene, tetrachloro- perchloroethylene tetrachloroethylene $CCl_2:CCl_2$	150	121
B070	ethene, trichloro- ethinyl trichloride trichloroethylene $CHCl:CCl_2$	[2] 1.10 [3] 1000	87
B080	methane, dichloro- methylene chloride- methylene dichloride CH_2Cl_2	20,000	40
B090	methane, tetrachloro- carbon tetrachloride CCl_4	800	77
B100	methane, trichlorofluoro- trichloromonofluoromethane CCl_3F	1,100	24

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[1] Ex. A to Ex. 1
[2] Ex. 2, p. 24
[3] Handbook of Chemistry and Physics, 44th Edition.
[4] PC 7

The term is used in the prohibitions of Sections 729.240 and 729.242: wastes are prohibited if they contain non-aqueous liquid phases which are halogenated solvents, or if they form such phases on mixing with water.

As has been discussed above, non-aqueous liquid phases are a threat to liner integrity, whether they contain halogenated compounds or not. The concentration level has been specified so as to distinguish halogenated solvent phases from other organic solvent phases. Although such phases pose a similar threat to liner integrity, the Board will not expand the scope of this rulemaking to include other organic solvents. The 1.4% has been set to correspond roughly with 1% total organic halogen, which appears to be the limit of detection using combustion methods which is discussed below. Solvent phases which contain less halogen will be addressed in a future rulemaking.

Section 729.223 Halogen Content Presumption

This Section creates a presumption that, in a non-aqueous phase, 1% total organic halogen equals 1.4% of the halogenated compounds. This allows the use of total organic halogen instead of actual weights of compounds. The presumption could be overcome if someone wanted to do an actual analysis.

Dr. James S. Smith testified that actual analysis of the compounds would require chromatography with mass spectrometry, a very time-consuming and expensive analysis (R. 792, 812). At the hearing, he testified that total organic halogen would be a less expensive method, but in a post-hearing submittal, backed off his recommendation (R. 799, 809, 811, Ex. 26, 27). However, the Board will allow it, on the assumption that sufficient test protocols will be developed.

The limit of the ASTM methods appears to be around 1% of the sample, which the Board has chosen as the threshold dividing halogenated solvents from other organic solvents (R. 799, 810, Ex. 27). The Board assumes that test methods can be developed which will have a detection limit comparable to the ASTM methods.

Section 724.443(b) contains an HCl emission standard for hazardous waste incinerators. Section 724.440 "exempts" the operator from this standard if the waste contains insignificant concentrations of hazardous constituents. In adopting the equivalent rule, USEPA indicated that the HCl standard would not apply if the waste feed was less than

0.5% organically bound chlorine (47 Fed. Reg. 27516, 27526, June 24, 1982)(R. 747, 799, Ex. 2, p. 8). The level of analysis required for this rule is approximately the same as that required for this proposal.

One problem with using total organic halogen is that the conversion factor to the weight of the compounds depends on the percent of halogen present in the various compounds. In the compounds listed in Section 729.221, only chlorine would show up in the total organic halogen test, since fluorine is not oxidized under its conditions (Ex. 27(c)). The compounds range from 31.3% to 90.9% chlorine. The conversion factor of 1.4 is based on 70% chlorine, which would be the chlorine content of a mixture of equal weights of the halogenated compounds of Section 729.221.

The extreme examples of the divergence of halogen percentages from actual quantities are chlorobenzene and carbon tetrachloride. The impact of prohibition at 1% total organic halogen is to ban chlorobenzene at around 3% and carbon tetrachloride at 0.9%. It should be noted that this may be the reverse of the order of relative toxicity (R. 1031, 1049, Ex. 1). However, the ban levels are not directly related to toxicity considerations, but rather to the effect on liners. Section 729.223 applies only to non-aqueous phases, where the other 99% may be just as toxic as the chlorinated compound. Moreover, the prohibition is based on the impact of non-aqueous phases on liners regardless of chlorinated solvent content. The concentration level is set at the level of convenient detection so as to distinguish such phases from other solvents, which will be the subject of future rulemakings.

The conversion factor from total organic halogen to actual weights is a presumption which could be overcome if someone actually analyzed for the weights of the compounds present. It would be to the generator's advantage to do this if the waste contained an halogenated compound with more than 70% halogen, or if the waste included halogenated compounds not listed in Section 729.221.

An alternative would be to move to generic regulation of halogenated compounds without reference to specific compounds (R. 349, 411, 426, 746, 799, Ex. 14, App. IX, p. 7). The Board declines to so expand the scope of this rulemaking. However, the present structure of the proposal would make it easy to amend the rules to move to generic regulation.

Section 729.224 Partition Presumption

It is assumed that the concentration of halogenated compounds in any non-aqueous phase exceeds the concentration in the entire system and in any aqueous phase. Therefore, proof that the total organic halogen concentration in a non-aqueous phase is less than 1% is sufficient to show that the concentration in any aqueous phase is less than 1%. Also, proof that the total organic halogen concentration in an aqueous phase exceeds 1% is sufficient to show that the non-aqueous phase exceeds 1%.

The partition presumption is based on the fact that halogenated solvents will preferentially migrate into the non-aqueous phase (R. 904, 906). Its primary use is to allow sampling of the non-aqueous phase to establish an upper limit on concentrations in other phases, thereby avoiding excessive sampling (R. 789, 792, 800).

Section 729.240 Non-aqueous Liquid Phases which are Halogenated Solvents

This Section prohibits landfilling of wastes which contain a non-aqueous liquid phase which is an halogenated solvent. Sections 729.222 and 729.223 define these phases essentially as those with more than 1% total organic halogen. This Section prohibits wastes which are pure solvent with 1% halogen content, and wastes which are mostly water or solids, but with an halogenated solvent phase, and wastes lying between these extremes.

Solid wastes are subject to a proviso referencing Section 729.243. This is worded as a proviso to place the burden of showing that the waste is a solid on the person seeking to avoid the prohibition.

As has been discussed in connection with the impact on liners above, this prohibition utilizes the presence of a non-aqueous liquid phase as the primary indicator. Such phases present a threat to liners regardless of the concentration of chlorinated compounds. The 1% halogen content rule has been set at the practical level of detection in order to differentiate the phase from other organic solvents (R. 795, 797, 810, 812, 836, 882, 884; Ex. 26, Addendum; Ex. 27).

The California regulations are written in terms of concentrations of halogen in the bulk waste, while this proposal measures the concentration in the solvent phase (or in the aqueous phase under the next section) (Ex. 14). This focuses attention on the most troubling component of the waste (R. 902). It also avoids difficulties in obtaining representative samples of multiphase wastes (R. 800). And, it encourages separation, and discourages creation, of multiphase wastes which pose more problems for disposal or recycling (R. 410, 738, 769, 773).

As has been discussed above, there is adequate existing capacity to recycle or incinerate the halogenated solvent phases produced in the State.

Section 729.241 Aqueous Solutions of Halogenated Compounds

This Section prohibits landfilling wastes which contain aqueous liquid phases with more than about 1% total organic halogen. As defined in Section 729.220, "aqueous liquid phases" are "phases" in which water is the solvent with more than 500 g of water per kilogram. If the phase is less than 50% water, it is a non-aqueous liquid phase which may be prohibited under Section 729.240.

As was discussed above in connection with the impact on liners, solutions which are more than 50% organic solvents may cause cracking in clay liners, and aqueous solutions which are more than 1% halogenated compounds may cause failure of synthetic liners (R. 482, 512, 514, 521, 525, 533, 535, 875, 899 and 901). The Board has set the limitation on halogenated compounds in aqueous solution at about 1%, based on the impact on synthetic liners. This number corresponds with what appears also to be the practical level of detection by oxidation methods.

Section 729.241(b) creates a presumptive conversion factor of 1.4% halogenated compounds equals 1% total organic halogen. This is identical to the conversion used in Section 729.223. The partition presumption of Section 729.224 can be used to set an upper bound on the halogenated compound concentration in the aqueous phase based on analysis of a non-aqueous phase.

It should be noted that 1% has been used both to define the halogen level at which a solvent is treated as "halogenated", and to set the ban on aqueous solutions. These numbers happen to be the same, but in principle there is no reason why they have to be.

At the hearings, Dr. Smith suggested a terminology based on "polar" and "non-polar" solvents, the distinction being that the polar solvents are miscible with water, while the non-polar solvents are not (R. 871). One problem with this terminology is that some polar compounds, when not mixed with water, need to be treated the same as the non-polar compounds; that is, one would apply one rule to non-polar solvents and undiluted polar solvents, and a second rule to polar solvents dissolved in water (R. 874, 890, 902, 909). Therefore, the polar/non-polar distinction, although relevant, does not divide the wastes along the desired boundary. The Board has instead emphasized the water concentration in phases to determine whether Section 729.240 or 729.241 applies. Only the polar solvents are capable of dissolving in water sufficiently to approach 50% to form a non-aqueous phase. Trace organic halogens will be regulated under the one rule or the other depending on the relative concentration of water and polar solvents.

As noted in Table I, only one of the halogenated compounds is soluble in pure water at a level of more than 1%. However, other organics dissolved in water can increase their solubility (R. 1154).

As is discussed above, the aqueous phases may be incinerated or treated in other ways, although some generators may have difficulty immediately finding existing capacity. If so, petitions for variances or site specific relief may be submitted. It should be noted that these wastes are probably liquids subject to the statutory prohibition under Section 22.6 of the Act.

Section 729.242 Solids Containing Halogenated Compounds

This Section prohibits solid wastes which form a non-aqueous liquid phase which is an halogenated solvent when the waste is mixed with water. The first question is whether a non-aqueous phase forms on mixing with water. Then the phase is tested for organic halogen content to determine whether it is an halogenated solvent (R. 887, 903). This prohibition is directed at the potential for formation of a non-aqueous liquid phase if the waste comes into contact with water after it is landfilled. As has been noted in connection with the discussion on liners and on §729.240, such non-aqueous liquid phases pose a threat to liners regardless of the concentration of halogenated compounds.

The first proposed Order also included tests based on the halogenated compounds in the bulk waste and in any free liquid which might be present in the waste. The latter test has been dropped in favor of language making it clear that any free liquid would render the waste not a solid and hence subject to the preceding sections. The testing of the bulk waste has been dropped based on the difficulties in obtaining a representative sample, and on assurances that halogenated compounds which would not be extractable as a separate phase would not pose a threat to liners (R. 800, 887, 903).

As is discussed above, wastes containing solids can be incinerated, although some generators may have difficulty in immediately finding existing capacity. If so, petitions for variances or site specific relief may be submitted.

Section 729.261 Dry Cleaning Wastes

This Section defers the ban for dry cleaners which generate less than 100 kg/mo. of contaminated wastes for two years. This will give them time to develop existing capacity, or to seek a rule related more closely to conditions in their industry.

Typical dry cleaners conduct recycling activities on the premises. Wastes include distillation residues and filters from which all recoverable solvent has been stripped. These are usually landfilled with general refuse (R. 287, 294, 302, PC 5).

The 100 kg/mo. corresponds with the level at which manifests are required under Parts 723 and 809, which the Board assumes apply to dry cleaning wastes. Dry cleaners indicated at the hearings that they had been preparing to comply with the manifest requirements of Part 809 where more than 100 kg/mo. was generated (R. 292, 297, 299). It should be noted that the 100 kg/mo. exemption applies only to the manifest requirement, not the supplemental wastestream requirement of Section 807.211, although that rule is difficult to enforce without the manifest requirement.

There are about 1400 dry cleaners at scattered locations in the State (R. 295). A small dry cleaner handles about 1500 pounds of cleaning per week (R. 289). With good recycling equipment, this will generate just under 100 kg per month of residues (R. 303). Incineration of this residue is expected to cost about $15,000 per year for the dry cleaner (R. 290). The economic impact study found incineration to cost less than $200 per drum (Ex. 2, p. 42). Assuming that the 100 kg per month would amount to less than 1 drum, the cost should be only about $2,400 per year. The difference may result from transportation costs since dry cleaners are scattered all over the State, and there are only two incinerators. Economical incineration of these wastes at this time may be more difficult. The Board has therefore postponed the ban for dry cleaners presently outside the manifest system.

Section 729.262 Recycling Residues

This Section defers the prohibition as applied to recycling residues until July 1, 1986. As is noted above, incineration of wastes with solids requires more elaborate equipment than liquids, although both operating incinerators in Illinois are capable of handling solids and appear to have adequate capacity for the existing and foreseen recycling residues. However, any regulation which would prevent or raise the cost of recycling would tend to defeat the purpose of Section 22(h) of the Act. The Board will therefore postpone the ban on these wastes to allow time for development of additional capacity, or for recyclers to propose a rule to the Board addressing their particular problems.

After July 1, 1986 the recycling residues rule will have no effect, and whether the waste can be landfilled will depend on the general provisions. This rule applies only to Subpart B of Part 729, and is not an exemption to the other bans. Therefore, residues which contain free liquids will be subject to the other bans.

The rule requires recycling of at least 30% of the solvent to qualify as a recycling reside. This is to prevent token recycling.

Section 729.263 Small Quantity Generators

This authorizes landfilling by persons who generate less than 1 kg/mo. of solvent waste. As used in this Section the mass of solvent in the waste is the determining factor (R. 251).

The 1 kg is determined by a 12 month moving average. To determine applicability, a generator adds up the preceding 11 months. The amount which can be landfilled in the current month is the difference between that sum and 12 kg. The idea is to look to long term performance rather than having generators subject to the prohibition during some months but not others.

Like the RCRA and Part 809 small quantity rules, the exemption depends on the quantity generated rather than the quantity landfilled. The alternative approach would allow even very large generators with recycling capacity to landfill 1 kg per month. It should be more economical for large generators to adopt more sophisticated disposal or recycling techniques.

At the final hearing CBE requested a small quantity rule of 1 kg per landfill per month. Although this would be easier to enforce, it could be too restrictive in terms of the amount of halogenated solvents which could be safely handled. Furthermore it fails to differentiate landfills on the basis of size (R. 245, 249, 259). It would also be difficult to enforce against generators and transporters who would not know the quantity the landfill had received.

The 1 kg quantity may be determined by several methods, including mass balance analysis of the processes responsible for generation of the waste (R. 801, 822, 837).

This second first notice Opinion supports the Board's second first notice Order of this same date. The first notice Opinion and Order of May 5, 1983 are withdrawn. Because of their length, the second first notice Opinion and Order will not be published in the Opinion volumes, but will be distributed to participants. The proposal will be published for first notice in the Illinois Register; the record will remain open for a period of 45 days for public comment following publication in the Illinois Register.

Board Member Bill Forcade abstained.
Board Member J. Theodore Meyer dissented.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify that the above second first notice Opinion was adopted on the 8th day of March, 1984 by a vote of 4-1.

Christan L. Moffett
Christan L. Moffett, Clerk
Illinois Pollution Control Board