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™ VELSICOL CHEMICAL CORPORATION

POST CLOSURE
MAINTENANCE & MONITORING PLAN

St. Louis Plant Site

March 1985
Ref. No. 1524

CONESTOGA-ROVERS & ASSOCIATES LIMITED

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1.0 INTRODUCTION

Under the provisions of the Technical Appendix to the Consent Judgment for the environmental securement of its St. Louis, Michigan, Plant Site, Velsicol Chemical Corporation (Velsicol) is required to implement a Post-Closure Maintenance and Monitoring Plan. The Plan is to remain in effect for the duration of the Consent Judgment or as otherwise specified within the document.

This report presents the Post-Closure Maintenance and Monitoring Plan. Provisions for routine and contingency maintenance following site closure, and for monitoring at the site at the frequency and for the duration specified by the Consent Judgement are described in detail.

2.0 CUSTODIAL PERSONNEL

Immediately upon completion of all containment construction required pursuant to the Consent Judgement, Velsicol retained a competent and trained custodian for the site.

The custodian is familiar with the closed plant site, the operating systems within the site and the wastewater disposal well. He will be responsible for all routine inspections and will report to Velsicol all current or impending problems associated with the site. The custodian will arrange and supervise all maintenance, inspections and repairs required by the Consent Judgment as detailed in this Maintenance and Monitoring Plan.

Velsicol has completed contractual arrangements for the permanent site custodian. The name, address and telephone number of the site custodian has been provided in writing to the Michigan Department of Natural Resources (MDNR) and the United States Environmental Protection Agency, Region V (USEPA) and is included in Appendix A. The alternate site custodial function and quarterly compliance monitoring will be undertaken by Conestoga-Rovers and Associates Limited.

For emergency matters, the site custodian should be contacted in the first instance. Routine or administrative matters pertaining to the maintenance and monitoring of the site should be referred initially to the Velsicol Corporate Supervisor. A complete list of contacts for emergency and routine or administrative matters pertaining to the maintenance and monitoring of the site is provided in Appendix A.

In the event of a change in designated personnel, Velsicol will, within seven days, notify the MDNR and the USEPA of such change in writing.

3.0 MAINTENANCE PROCEDURES

3.1 SECURITY

An 8-foot high, industrial grade, chain link fence has been installed on the entire perimeter of the plant site. The fence has two gates (one 20-foot double leaf vehicle gate and one 4-foot man gate) which are locked at all times. Both gates are located at the intersection of North Street and Bankson Street. Distribution of the keys for the gate locks is as follows:

Velsicol Chemical Corporation
Conestoga-Rovers & Associates Limited
Custodian
City of St. Louis Police Department

Signs visible from all angles of approach are posted along the fence and bear the following legend:

WARNING
TOXIC CHEMICAL BURIAL AREA
KEEP OUT

A granite marker, located inside the gate and visible from the road, is inscribed with the following legend:

WARNING

DO NOT ENTER

This Fenced Area Was The Site Of A
Chemical Plant. The Ground Contains
Chemicals Which May Be Toxic or
Hazardous And Also Contains Low
Level Radioactive Waste. The Area
Has Been Capped and Secured.

TRESPASSING

STRICTLY PROHIBITED

3.1.1 Maintenance of Security

At least weekly and during site inspections following major rainstorms, the security fence will be inspected visually for integrity and acts of vandalism. All locks and closure devices will be inspected for signs of attempted forced entry and will be operated to ensure functionality. All signs will be inspected for visibility and replaced as required.

Repairs to ensure the maintenance of security will be completed immediately following identification of deficiencies.

3.2 ACCESS ROADS

The secured plant site contains a gravel surface access road which begins at the North Street gate and parallels the Pine River Embankment security fence to a point near the southwest corner of the plant site. Turnarounds are located at the pumphouse and in the southwest corner of the plant site.

3.2.1 Maintenance of Access Roads

At least weekly, and following all major rainstorms, the access roads will be inspected for rutting, ponding and erosion. Maintenance will be performed on an as-required basis by grading and the application of gravel and calcium chloride. Snow plowing will be performed during the winter season as required to maintain access.

3.3 CLAY CAP AND VEGETATIVE COVER

The entire plant site has been capped in accordance with the requirements of the Technical Appendix to the Consent Judgment. The cap consists of 1.5 to 3.0 feet of clay compacted to a hydraulic conductivity of 1.0×10^{-7} cm/sec or less. The clay cap is overlain by a 4-inch thick sand drainage blanket and a 6-inch layer of topsoil. The topsoil has been hydraulically seeded with a standard Michigan Department of Transportation shallow rooted grass seed mix. All drainage swales were sodded.

3.3.1 Maintenance of Clay Cap and Vegetative Cover

At least twice per month and following all major rainstorms, the clay cap and vegetative cover will be inspected for erosion, settlement, surface cracking or other surface failure. Special attention will be paid to areas of the clay cap which are adjacent to or overlying surface or subsurface structures and appurtenances (e.g. groundwater collection system, gas vents and monitoring wells, clay cap and containment wall interface). Special attention will also be paid to the areas of the plant site such as the drainage swales which are most susceptible to surface erosion. The site surface will be inspected on the same frequency for the presence of deep rooted vegetation (eg. wild carrot, trumpet vine, saplings, etc.) and for the presence of burrowing mammals.

Should significant erosion, settlement or other surface failure occur, appropriate action to repair the damaged areas will be implemented in a timely fashion in accordance with the construction specifications stipulated by the Consent Judgement. The USEPA and the MDNR will be immediately notified prior to the initiation of any repairs to the clay cap. Should the presence of burrowing mammals be noted, the mammals will be humanely trapped and relocated and the burrows will be excavated, backfilled, compacted and re-seeded, all in accordance with the construction specifications stipulated by the Consent Judgement.

Vegetative cover will be fertilized twice per year (spring and fall) with fertilizer bearing a nutrient formula of 4-10-32. This formulation is based upon recent soil analysis data of samples collected from the site topsoil. Should the relative soil nutrient proportions change as evidenced by analysis of topsoil samples collected on a bi-annual (two year) basis during the term of the Consent Judgment, the fertilizer/nutrient ratio will be adjusted accordingly. Cutting of the vegetative cover will be performed approximately five times per year but will be revised as necessary, dependent upon weather conditions during the growing season, in order to maintain the height of vegetation at eight to ten inches. Any areas noted to be unvegetated will be top dressed with topsoil, fertilized and re-seeded.

Application of herbicides to control the growth of deep rooted vegetation or other undesirable species will be performed following approval of USEPA and MDNR.

3.4 INTERNAL GROUNDWATER COLLECTION SYSTEM

In accordance with the provisions of the Technical Appendix to the Consent Judgment, Velsicol has installed a groundwater collection system underlying the plant site. The system is comprised of 6-inch diameter perforated vitrified clay tile which drain directly to a series of manhole sumps. In addition, 4-inch diameter perforated vitrified clay tile lateral drains terminating in granular collector sumps were installed from the main 6-inch collector drain into the plant site interior.

An existing reinforced concrete in-ground tank with a capacity of approximately 250,000 gallons was retro-fitted and is used as an interim storage and settling tank for collected groundwater prior to deep well injection. The collected groundwater is pumped from the storage tank through approximately five miles of 8-inch, 6-inch and 4-inch diameter steel or asbestos-cement pressure forcemain to the disposal well.

3.4.1 Groundwater Collection

Groundwater will be collected periodically from the collection sumps on an as-required basis and transported to the on-site storage tank. Groundwater collection will commence when the arithmetic mean elevation of the site groundwater, as determined by water level measurements of the 14 site monitoring wells, exceeds elevation 724.13. Should the average groundwater elevation exceed 724.13 the groundwater will be pumped from the collection sumps directly to the on-site storage tank using 3-inch diameter pumps each with a rated capacity of 360 gallons per minute. Vinyl coated rubber discharge hoses will be used as the method of conveyance from pump to storage tank. All pumping equipment will be site dedicated and will be allowed to thoroughly drain to the collection sump or storage tank after use and prior to storage. Groundwater will be pumped until the average site groundwater elevation is less than elevation 724.13. The final average groundwater elevation after pumping will be selected by Velsicol.

Preliminary water level measurements taken at site monitoring wells during August 1984 indicate that the present average site groundwater elevation is approximately 721.50.

3.4.2 Maintenance of Collection System

Each time that groundwater pumping is required, the subsurface collection piping will be visually inspected. This inspection will be performed by placing a bright light in a manhole invert and observing it through the pipe from adjacent manholes and collection sumps. Any blockage which significantly impedes flow will be removed in a timely manner. Should excavation be required in order to effect cleaning or repairs, the USEPA and MDNR will be notified prior to commencing the repair or cleaning.

Twice each year, or whenever groundwater pumping is required, the manholes and manhole sumps will be inspected visually for damage to covers, damage to the manhole structure by fracturing, cracking or crumbling, damage to manhole tops and the presence of excessive sediments within the sumps. Repairs and cleaning will be performed on an as-required basis for the duration of the Consent Judgment. Should the repair or cleaning involve excavation, the MDNR and USEPA will be notified prior to commencing the repair or cleaning. Sediments removed from manhole sumps will be collected and dewatered, packaged, labeled, marked, accumulated, manifested, transported and disposed of in full accordance with RCRA and all other State and Federal requirements.

Each time that groundwater pumping is required, pumps, couplings and discharge hose will be inspected for leaks prior to use. All necessary repairs will be completed prior to commencing pumping of collected groundwater. The pumps and hoses will be maintained in accordance with the manufacturers specifications during extended periods of storage. The pumps and hoses will be stored in the on-site pumphouse.

3.4.3 Maintenance of Storage Tank

Twice each year routinely, and each time that injection to the disposal well is required, the storage tank will be inspected visually for damage by fracturing, cracking or crumbling and for the presence of excessive sediments within the tank. Repairs and cleaning will be performed on an as-required basis for the duration of the Consent Judgment.

Should solids removal from the tank be necessary, sediments will be collected and dewatered, packaged, labeled, marked, accumulated, manifested, transported and disposed of in full accordance with RCRA and all other State and Federal requirements.

3.4.4 Maintenance of Injection Pump and Piping

The injection pump and diesel engine will be maintained in accordance with the manufacturer's specifications. The instrumentation will be inspected and calibrated at least once per year. Prior to and during deep well injection, the instrumentation will be inspected to ensure that it is operational. Repair or replacement of nonfunctional instrumentation will be completed prior to the resumption of injection.

The injection pump will be inspected for ruptured or worn seals, worn bearings and cracked or worn housing in accordance with the manufacturer's recommendation and at a minimum, yearly. Any required repairs will be made expeditiously.

Once in each operating year, the injection forcemain will be hydrostatically tested to demonstrate compliance to the following standards. The forcemain will sustain for four continuous hours a pressure equal to or greater than 125 percent of the maximum operating pressure. Furthermore, as the subsurface portions of the forcemain cannot be visually inspected for leaks, the forcemain will sustain for an additional four continuous hours a pressure equal to or greater than 110 percent of the maximum operating pressure. During each injection, the aboveground pressure mains will be inspected visually for leaks and excessive movement or vibration. Repairs to the injection pipeline will be made expeditiously on an as-required basis.

All test results will be forwarded to USEPA and MDNR within seven days of the completion of the testing program.

Injection to the deep well will be performed in accordance with the attachment to the Consent Judgment entitled "Operating Procedures for Deep Well". This attachment is included as Appendix B to this report.

During the winter months, when the pump and pipeline are not in use, the pipeline will be winterized by the injection of 26 percent calcium chloride solution into the system. All valves will be closed and locked and the pump will be de-commissioned, cleaned, greased and stored.

3.4.5 Maintenance of Deep Well

All groundwater injection to the deep well will be in accordance with the standards presented within the attachment to the Consent Judgment entitled "Operational Procedures for Deep Well". This attachment is included as Appendix B to this report.

Additionally, during periods of groundwater injection the well head piping, instrumentation and appurtenances will be observed at least twice daily to ensure that the well and instrumentation are functioning correctly.

The well head buildings and fence will be inspected weekly and after each major storm for wind damage, vandalism and security. During periods of non-use all valves will be closed and locked. The locks will be inspected weekly for signs of tampering. Concrete floor slabs will be inspected weekly for damage by fracturing, cracking or crumbling. The spill containment collection sump will be pumped on an as-required basis. Collected liquids resulting from well head spills or leaks will be transported to the plant site by a licensed hazardous waste transporter and discharged to the on-site holding tank.

Once per year the integrity of the well annulus will be tested in accordance with testing protocol required by the MDNR or by the Underground Injection Control (UIC) Permit for the well which may be issued in the near future. Testing protocol specified by the UIC permit will be added to or will replace the testing program contained in this plan. All test results will be forwarded to USEPA and MDNR within seven days of the completion of the testing program.

Any repairs or adjustment to the well or instrumentation shall be performed in a timely manner. MDNR and USEPA will be notified in advance of any repair or maintenance operation which causes the well to be inoperable, and the length of time estimated to complete the necessary repairs or maintenance.

4.0 POST-CLOSURE MONITORING PLAN

The following post-closure monitoring plan outlines the required site monitoring as outlined in the Consent Judgment.

4.1 SITE PERIMETER CONTAINMENT WALL

Under the provisions of the Technical Appendix to the Consent Judgment, one core sample from the installed site perimeter containment wall will be collected each three months for a period of three years. The collected samples will be used to demonstrate the ability of the containment wall to maintain a hydraulic conductivity of 1.0 x 10^{-7} cm/sec or less using a falling head permeameter in accordance with ASTM D 2434. The first sampling event occurred on December 15, 1983. Subsequent samplings occurred March 15, 1984, June 15, 1984, September 14, 1984 and December 13, 1984.

Analysis of the data was performed as described in Subsection 8.a.4 and 8.d of the Technical Appendix to the Consent Judgment and in accordance with the reference text "Laboratory Soils Testing", Department of Army Engineering Manual EM-1110-2-1906. All collected samples to date have exhibited a hydraulic conductivity of less than 1.0 x 10^{-7} cm/sec.

Further sampling and testing of the site perimeter containment walls will be performed at 3-month intervals until December 1986.

Test data will continue to be reported to USEPA and MDNR within 30 days of completion of laboratory testing. A summary data report will be prepared and submitted to USEPA and MDNR upon completion of the entire testing program

4.2 SITE GROUNDWATER

Under the provisions of the Technical Appendix to the Consent Judgment, Velsicol has installed at the plant site a network of 14 groundwater monitoring wells. The wells were bottomed at an elevation of 718.0 and were screened to within 3.5 feet of the finished site surface elevation. Each well is fitted with a vented locked cap. The elevation of each well head was determined by field survey to an accuracy of 0.01 feet.

Static water levels for each well will be determined at quarterly intervals for the duration of the Consent Judgment. For the sake of efficiency the water level measurement program commenced on December 12, 1984 to allow monitoring to proceed concurrently with the collection of the monitoring to proceed concurrently with the collection of the containment wall sample. A weighted chalked surveyors tape, graduated to one one-hundredth of a foot, will be lowered below water surface and a measurement of the distance between well head and the water surface will be determined. The resultant dimension will be deducted from the previously established well head elevation in order to determine the groundwater elevation. The well head elevations will be surveyed once per year to ensure the accuracy of the elevations. At the time of each set of well measurements, the elevation of the water level in the Pine River St. Louis Reservoir will also be determined. For each set of field data, Velsicol will calculate the groundwater table elevation at the plant site by determining the arithmetic mean of all static well water levels measured.

A groundwater table contour map of the plant site shall be developed from this data quarterly for the first five years following completion of all construction activities. All raw data and the completed contour map will be submitted to USEPA and MDNR within four weeks following each set of measurements.

At the time of the well measurement, each well will be inspected for corrosion or damage to the well head, caps and locks. Repairs will be completed in a timely fashion on an as-required basis.

If during the maintenance period any monitoring well should not perform in a satisfactory manner or suffer irrepairable damage, Velsicol will expeditiously install a new well adjacent to the location of the failed or damaged well. The non-functional well will then be removed and the resultant cavity will be plugged using a cement/bentonite grout.

All supporting data for installation of the new well will be submitted to USEPA and MDNR at that time.

4.3 GAS VENTS

Gas vents will be sampled on a quarterly basis for three years commencing on December 13, 1984. Samples will be collected and analyzed in accordance with the protocol detailed in Appendix C.

If during this three year period the concentration of indicator volatile organic compounds are equal to or less than the maximum allowable concentrations provided below, vent sampling will be discontinued and the carbon filters will be replaced on a three year frequency. Should the data collected during the initial three year sampling period indicate levels in exceedence of those specified below, the carbon filters will be changed immediately and a revised sampling program will be submitted to the USEPA and MDNR. The compounds for which analysis will be undertaken and the maximum allowable limit for each are:

Compound	Maximum Allowable Concentration
Carbon Tetrachloride	119 mg/m^3
Trichloroethylene	2.985 g/m^3
Vinyl Chloride	2.09 mg/m^3

At the time of sampling, the gas vents will be inspected for corrosion or damage. Any necessary repairs will be performed expeditiously.

At the time of carbon changeout, spent carbon will be packaged, labeled, marked, accumulated, manifested, transported and disposed of in full accordance with RCRA and all other State and Federal requirements.

4.4 DEEP WELL INJECTION

During the injection of wastewater to the deep well, samples will be collected twice daily and analyzed for pH, specific gravity and total suspended solids. Additionally, during periods of injection, the well head piping, instrumentation and appurtenances will be observed at least twice daily to ensure that the well and instrumentation are functioning correctly.

5.0 INSPECTIONS

Regular inspections of the closed plant site and its functional systems (groundwater collection and disposal, groundwater monitoring network and gas vents) will be conducted in accordance with the inspection and preventive maintenance program performed by the site custodian.

These inspections will check for mechanical equipment malfunctions, structural deterioration, site groundwater recharge, erosion and settlements all which may require corrective action.

5.1 INSPECTION SCHEDULE

Table 1 presents the schedule for inspecting the closed plant site, groundwater monitoring, groundwater collection and disposal, perimeter containment, access roads, security, and gas venting systems.

Provided with each item is a list of problems which may be encountered. The frequency of inspection for each item is also indicated.

TABLE 1

INSPECTION SCHEDULE

AREA/ EQUIPMENT	SPECIFIC ITEM	TYPES OF PROBLEMS	FREQUENCY OF INSPECTION
Plant Site	Groundwater Collection System	Corrosion, damage to covers	Twice yearly
		Disintegration, damage to pre-cast manholes (fracturing cracking, crumbling)	Twice yearly
		Damage to steps	Twice yearly
		Pipes blocked	Whenever pumping is required
		Solids in sumps	Twice yearly
		Discharge hoses and pumps	Prior to use and whenever pumping is required
	Storage Tank	Structural integrity (fracturing, cracking, crumbling)	Twice yearly
		Solids in tank	Whenever injection is performed
	Pumps & Piping	Instrumentation - Calibrate	Yearly
		Piping - Leaks, vibration	During injection
		Injection pump, worn seals worn bearings, cracked or worn housing	Per Manufacturer's Recommendations
	Containment Wall	Core sample for permeability	Quarterly for three years

continued....

TABLE 1

INSPECTION SCHEDULE

AREA/ EQUIPMENT	SPECIFIC ITEM	TYPES OF PROBLEMS	FREQUENCY OF INSPECTION
Plant Site	Monitoring Wells	Groundwater elevation	Quarterly
		Corrosion/damage to well, caps and locks	Quarterly
	Gas Vents	Gas sampling	Quarterly for three years
		Corrosion/damage to vents, gauges	Quarterly
Disposal Well	Annulus	Integrity testing	Yearly
		External corrosion and scaling. Pressure	During injection
	Well Head Piping & Instrumentation	External corrosion, leaks. Instrument malfunction	Twice daily during injection
		Liquid sample for pH and specific gravity and suspended solids	Twice daily during injection
		Pressure, flow rate	Twice daily during injection
		Valves, locks	Weekly
	Buildings	Wind damage, vandalism security, signs	Weekly
		Floor slabs, fracturing cracking, crumbling	Weekly

TABLE 1

INSPECTION SCHEDULE

AREA/ EQUIPMENT	SPECIFIC ITEM	TYPES OF PROBLEMS	FREQUENCY OF INSPECTION
Security Devices	Perimeter Fence	Corrosion, damage to support posts and fabric	Weekly
	Gates & Locks	Corrosion, damage to hinges and fabric, locks sticking or corroding	Weekly
		Signs of unauthorized entry	Weekly
	Signs	Corrosion, damage to sign and hangers, visibility	Weekly
Plant Site	Access Road	Rutting, ponding, erosion or other surface damage	Weekly
		Maintenance of access following significant snowfall	Each occurence
	Clay Cap and Vegetative Cover	Erosion, settlement	Bi-weekly
		Surface cracking or failure	Bi-weekly
		Presence of deep rooted vegetation or burrowing mammals	Bi-weekly
		Vegetation burnout	Bi-weekly
		Excessive growth of vegetation	Bi-weekly

continued....

5.2 INSPECTION LOG

An inspection log will be maintained for each calendar year in a three ring binder that is subdivided by sections based upon frequency of inspection or monitoring (eg. weekly, quarterly, etc.). In addition, a pumping log will be maintained documenting flow rates, pressures, total daily flow, etc. A project diary will also be maintained and will record miscellaneous information including weather conditions, site visitors, general description of repairs performed, general site activities undertaken, instructions received from MDNR, USEPA or Owner personnel, etc.

The inspection and pumping logs and the project diary will be kept with the inspection schedule in the project offices located at 701 W. Washington Street, St. Louis, Michigan. Copies of the logs will be forwarded to the MDNR and USEPA monthly. Sample inspection logs are presented within Appendix D.

5.3 DISPOSAL WELL INJECTION LOGS

During periods of deep well injection, samples of disposed liquids will be collected twice daily and analyzed for pH, specific gravity and total suspended solids.

Analysis will be conducted at an on-site laboratory. A copy of the injection well sample analysis log is contained in Appendix E.

In addition, pumping rates and volumes will be recorded on standard MDNR log forms. A copy of the standard MDNR log form is also contained in Appendix E.

6.0 CORRECTIVE ACTION

Should inspections reveal that non-emergency maintenance or response is required, it will be completed as soon as possible in order to preclude further damage and the need for emergency repairs. Should a situation exist requiring immediate action, emergency or corrective action will be taken; custodial personnel will notify Velsicol's Manager of Environmental Engineering, MDNR and USEPA and initiate response actions. Releases from the facility including but not limited to pipeline leaks, shall be immediately reported to USEPA National Response Center pursuant to Section 102 CERCLA (42 USC 9601).

Should corrective or remedial action require excavation into the plant site soils, USEPA and MDNR will be notified prior to commencing the corrective action.

At a minimum, when the plant site mean groundwater elevation is determined to be higher than an elevation of 724.13 the collection system will be pumped until the average groundwater elevation is less than 724.13. When the storage tank contents reach a depth of ten feet, the collected liquid will be injected to the disposal well. Disposal of collected liquids to the disposal well will take place no later than 90 days following collection.

7.0 HEALTH, SAFETY AND PERSONNEL HYGIENE

Inspection, maintenance or repair activities involving the excavation, handling or transport of potentially contaminated materials will require the adherence by on-site personnel to the site health and safety provisions specified in the following sections.

7.1 PROTECTIVE CLOTHING AND EQUIPMENT

Velsicol shall supply protective clothing and apparel for site personnel including disposable outerwear, gloves and boots, respiratory protection and hard hats. Discarded clothing and equipment will be collected, packaged, labeled, marked, accumulated, manifested, transported and disposed of in full accordance with RCRA and all other State and Federal requirements.

7.2 DECONTAMINATION

Equipment or tools contacting potentially contaminated materials will be decontaminated by hot water high pressure cleaning prior to removal from site. Wash waters will be collected and disposed of in the on-site holding tank for ultimate deep well disposal. Sediments will be removed from the collection sump, dewatered, packaged, labeled, marked, accumulated, manifested, transported and disposed of in full accordance with RCRA and all other State and Federal requirements.

7.3 AMBIENT AIR MONITORING

Velsicol will monitor air quality in and around all excavations, the holding tank, and collection sumps during repairs to or cleaning of facilities. Monitoring will be for organic vapors using a direct reading organic vapor photoionizer or organic vapor analyzer. Should monitoring indicate organic vapor concentrations in excess of five parts per million (ppm), personnel will wear air purifying respiratory protection. The presence of organic vapor concentrations in excess of 25 ppm will necessitate the use of supplied air respiratory protection. Personnel entering enclosed structures such as manholes will wear supplied air respiratory protection. Explosivity monitoring will be conducted prior to entry into enclosed structures or excavations.

APPENDIX A

LIST OF CONTACTS

POST-CLOSURE MAINTENANCE AND MONITORING PLAN

LIST OF CONTACTS

i) Custodian

Mr. Gene DeGeer
Velsicol Chemical Corporation
701 West Washington Street
St. Louis, Michigan 48880
(517) 681-4285

or

3664 Water Road
Sanford, Michigan 48657
(517) 687-5312

i) Alternate Custodian

Mr. Don Robinson
Conestoga-Rovers & Associates Limited
c/o 701 West Washington Street
St. Louis, Michigan 48880
(517)681-4285

or

651 Colby Drive
Waterloo, Ontario
N2V 1C2
(519)884-0510

iii) Velsicol Corporate Supervisor

Mr. Thomas Shaffer
Manager of Environmental Engineering
Velsicol Chemical Corporation
Memphis Environmental Center
2603 Corporate Avenue, Suite 100
Memphis, Tennessee 38132
(901)345-1788

iv) St. Louis Fire Department

(517)681-3111

v) St. Louis Police Department

(517)681-2211

vi) Gratiot County Ambulance Service

(517)463-3222

vii) Gratiot Community Hospital

(517)463-1101

viii) Michigan Department of Natural Resources

Mr. Richard Johns, Chief
Groundwater Quality Division
Steven T. Mason Building
P.O. Box 30028
Lansing, Michigan 48909
(517)373-8000

or

Ms. Anne Couture
Groundwater Quality Division
P.O. Box 30028
Lansing, Michigan 48909
(517)373-2794

ix) United States Environmental Protection Agency

Mr. Peter Miller
Remedial Project Manager
Waste Management Division
USEPA, Region V
230 S. Dearborn St.
Chicago, Illinois 60604
(312)886-4783

x) USEPA National Response Center

1-800-424-8802

APPENDIX B

OPERATING PROCEDURES FOR DEEP WELL

ATTACHMENT

OPERATING PROCEDURES FOR DEEP WELL

ATTACHMENT

Operating Procedures for Deep Well

1. GENERAL

   1.1 Only liquids shall be disposed within the deep well, in accordance with the terms of these operating procedures.

   1.2 Any party operating or using the deep well shall take such actions as are necessary to insure compliance by its employees, agents and contractors with these operating procedures and shall be responsible for any damage to the deep well caused by its or their failure to comply with such procedures.

2. LIQUID QUALITY

   2.1 Liquids disposed within the deep well shall conform to the following parameters:

      2.1.1 Liquids shall be aqueous.

      2.1.2 Specific gravity shall be less than 1.220.

      2.1.3 Total suspended solid concentrations shall be less than 500 parts per million.

      2.1.4 pH shall be within the range 4.0 to 10.0.

   2.2 Pretreatment, if required, including pH adjustment, settling, filtering, etc., shall occur prior to injection, in tanks or other structures constructed for that purpose.

   2.3 Liquids disposed within the deep well shall be compatible with liquids disposed during prior periods. In particular, liquids that will precipitate solids, or cause an increase in the viscosity of liquids within the well or receiving geological stratum, will require pretreatment prior to injection.

3. INJECTION PRESSURE

During injection, pressure within the injection pipeline shall not exceed 150 pounds per square inch.

4. INSTRUMENTATION

Prior to and during injection, the operator will ensure that meters for recordation of pumping rate, well head pressure and annulus pressure are operational. Repair of nonfunctional recordation equipment will occur prior to injection of liquids.

5. COLD WEATHER OPERATION

5.1 During periods of cold weather operation, equipment, including the pump, pressure lines, well head, and meters, shall be protected from freezing by heat tracing or other methods.

5.2 Should the system be deactiviated during periods of cold weather, the well and pressure lines shall be injected with a brine or other liquid having a minimum of 26 percent calcium chloride in solution.

6. SPILL PREVENTION AND CONTAINMENT

6.1 Following injection, the well head block valve shall be closed and pressure released from the pump and pressure lines. During depressurization, liquids within the pump and injection mains shall be collected and stored.

6.2 Spill containment structures at the well head shall be maintained in a sound structural condition. Spilled liquids shall immediately be contained, and collected by vacuum tanker or other means.

6.3 In the event of a spillage at the well-head, the operator shall immediately notify Velsicol, the Michigan Department of Natural Resources ("MDNR") and EPA.

7. DOCUMENTATION

7.1 During periods of deep well injection, records conforming to the requirements specified by MDNR shall be maintained.

7.2 Form R-1120 (MDNR Monthly Operating Report) shall be prepared and submitted to MDNR on a monthly basis.

7.3 Daily records, including meter charts and sampling data, and the MDNR Monthly Operating Reports, shall be maintained by the operator and provided to Velsicol and MDNR on a monthly basis.

8. TESTING

Once in each operating year (or other time interval as required by MDNR) testing of the integrity of the well annulus and injection pressure mains shall be performed. Such testing shall meet the requirements specified by MDNR.

9. CO-ORDINATION

9.1 The operator shall at all times co-ordinate deep well activities with the landowner upon and adjacent to whose lands the deep well is located.

9.2 In the event of a dispute, Velsicol, MDNR and EPA shall be notified immediately.

10. PRIORITY OF ACCESS

10.1 Velsicol shall have priority of access, including, if necessary, sole access, to the deep well as follows:

10.1.1 Velsicol shall require approximately 20 days priority access during the installation of the upgradent storm sewer, which will most likely occur in May, June and/or July, 1983.

10.1.2 Velsicol shall require priority access for a period of approximately 90 days during the period May through September, 1984, during subsurface work on the main plant site.

10.1.3 Velsicol shall require priority access for a period of approximately 14 days during cleanup of subsurface main plant site oil contamination, which will most likely occur in April and/or May, 1983.

10.2 Velsicol shall give Michigan reasonable advance notice of the specific periods and dates during which it will require priority access under subparagraph 10.1.

10.3 Velsicol and Michigan shall use reasonable efforts to coordinate their respective deep well disposal activities.

11. MAINTENANCE AND REPAIR

11.1 The deep well may be closed for maintenance and repair as reasonably deemed necessary by Velsicol.

11.2 Velsicol shall give Michigan reasonable notice of any routine, non-emergency closing for such purposes.

APPENDIX C

GAS VENT SAMPLING AND ANALYTICAL PROTOCOLS

APPENDIX C

GAS VENT SAMPLING PROTOCOL

In accordance with the Consent Judgment, Velsicol has submitted a post-closure maintenance and monitoring plan for its environmentally secured plant site in St. Louis, Michigan. The post-closure maintenance and monitoring plan requires quarterly monitoring of 11 gas vents that have been installed to release and appropriately treat internal gases. This program will be conducted over a period of three years.

The gas vents, as detailed in Exhibit F of the Consent Judgment, are designed with two sampling ports; one below the base of the installed activated charcoal filter, and one above the filter. Samples will be collected from the downstream port. Results will indicate whether or not containment breakthrough has occured through the carbon filter.

Samples will be analyzed for three separate compounds: carbon tetrachloride, trichloroethylene and vinyl chloride.

Samples will be collected with a Gilian HFS-113 AU DK variable flow pump. This particular unit allows the operator to run a series of tubes concurrently in parallel arrangement. Four tubes will be collected from each gas vent: two standard NIOSH 100/50 mg activated charcoal tube, and two 30/15 mg tenax tubes, each tube measuring 6 mm x 70 mm. One blank set each and one duplicate set each of charcoal and tenax tubes will be collected during each quarterly sampling event.

As vinyl chloride represents the least adsorptive of the three compounds, the sampling program is designed to accomodate this compound. Therefore, sample volume shall not exceed 5 liters.

Prior to sampling, the vent will be sealed off with a plastic cap, and purged for 10 minutes at a rate of 500 cc/min. This is to eliminate the possibility of sampling atmospheric air contained within the upper portion of the gas vent.

Two samples from each gas vent shall be collected simultaneously at a rate of 250 cc/min. for 20 minutes. The pump shall be lab calibrated with sample tubes in-line to determine the exact flow rate. Additionally, flow will be checked after field sampling to verify that a constant flow was maintained throughout the sampling period.

Following sample collection, each tube will be sealed with a plastic cap at each end, labelled, placed in a cold storage environment and shipped under chain-of-custody via a commercial courier service to Velsicol's analytical laboratory in Memphis.

Analysis of the charcoal tube will be conducted in accordance with NIOSH protocol as detailed below:

Compound	Revised Method No.
Carbon Tetrachloride	1003
Trichloroethylene	S-336
Vinyl Chloride	1007

Analysis will proceed by first eluting the carbon sample tubes with carbon disulfide and then analyzing by GC with a flame ionization detector. All samples will be initially analyzed in this fashion. If any of the above compounds are detected on the charcoal tube, the corresponding tenax tube will be analyzed by thermal desorption and GC/MS under EPA Method 624.

Turnaround time for the completed analysis at the laboratory is anticipated to be 30 days from date of sample collection. Samples will be desorbed within the 10 day limit specified for vinyl chloride. Analytical data will be reported to CRA as mg/tube. Final results for the carbon tube will be calculated by CRA, using the following formula.

1. Corrections for the blank to be made for each sample
   mg = mg sample - mg blank

   This calculation is performed separately for each tube.

2. Add the amounts present in the front tube and backup tube to determine the total weight in the sample.

3. Calculate the corrected mg/sample by dividing the total weight by the desorption efficiency (D.E.) which is provided by the lab.

   $$\text{corrected mg/sample} = \frac{\text{total weight}}{\text{DE}}$$

4. Calculate the concentration of the analyte in air

   $$\text{mg/m}^3 = \frac{\text{Corrected mg} \times 1000 \text{ liters/m}^3}{\text{Air volume Sampled (liters)}}$$

5. Concentration will be reported as ppm, corrected to standard conditions of 25°C and 760 mm Hg

   $$\text{ppm} = \text{mg/m}^3 \times \frac{24.45}{\text{MW}} \times \frac{760}{\text{P}} \times \frac{(\text{T}+273)}{298}$$

   where P = pressure (mm Hg) of air sampled
   T = temperature (°C) of air sampled
   24.45 = molar volume (liter/mole) at 25°C and 760 mm Hg
   MW = Molecular Weight
   760 = standard pressure (mm Hg)
   298 = standard temperature (°K)

NOTE: Temperature and pressure uncorrected to sea level will be collected for the duration of the sampling event and averaged for use in the above calculations. Information will be provided from the National Weather Service in Lansing, Michigan.

6. If the concentration of the back tube exceeds 10% of the concentration of the front tube, the results will be reported as a sample breakthrough and possible sample loss.

7. A similar procedure will be followed for the tenax tube, should analysis be required.

Data will be reported to USEPA and MDNR officials within seven days after receipt of final laboratory data for each quarterly sampling. Additionally, a summary data report will be provided at the conclusion of the three year sampling period, or sooner, should breakthrough of any compound occur prior to the three year program. All raw data will be made available to USEPA and MDNR upon request. This shall include, but not be limited to, field notes, sampling records, calibration logs, chain of custody forms and all manifestations of laboratory analytical data.

In addition to the set of field blanks to be collected per quarterly sampling event, an additional set of 15 charcoal tubes and 15 tenax tubes will be forwarded unopened to the lab during the initial sampling event.

These "blank" tubes will be used as internal calibration standards on which each of the three compounds will be spiked at five different concentrations. The data from this analysis will be used to calculate the desorption efficiency for each specific lot of activated charcoal and tenax tubes. Therefore, the lot numbers of carbon tubes and tenax tubes shall be recorded during each quarterly sampling. Should the lot numbers change, a new set of 15 charcoal tubes and 15 tenax tubes shall be forwarded to the laboratory for determination of the new desorption efficiency.

The allowable limits for these compounds have been established by the MDNR and are site specific for the St. Louis site. These limits are documented in section 4.3 of the post-closure maintenance and monitoring plan.

Copies of all three analytical protocols, the chain of custody and the data collection sheet are provided in the following sections.

FORMULA: Table 1

M.W.: Table 1

HYDROCARBONS, HALOGENATED

METHOD: 1003
ISSUED: 2/14/84

COMPOUNDS: (synonyms in Table 1)
benzyl chloride
bromoform
carbon tetrachloride
chlorobenzene
chlorobromomethane
chloroform
o-dichlorobenzene
p-dichlorobenzene
1,1-dichloroethane
1,2-dichloroethylene
ethylene dichloride
hexachloroethane
methylchloroform
propylene dichloride

SAMPLING

SAMPLER: SOLID SORBENT TUBE
(coconut shell charcoal, 100 mg/50 mg)

FLOW RATE: 0.01 to 0.2 L/min

VOL-MIN: Table 2
-MAX: Table 2

SHIPMENT: routine

SAMPLE STABILITY: at least 1 week @ 25 °C

BLANKS: 2 to 10 field blanks per set

ACCURACY

[illegible]

BIAS: not significant [1]

OVERALL PRECISION (s_r): see EVALUATION OF METHOD [1]

MEASUREMENT

TECHNIQUE: GAS CHROMATOGRAPHY, FID

ANALYTE: compounds above

DESORPTION: 1 mL CS_2, stand 30 min

INJECTION VOLUME: 5 µL

TEMPERATURES: Table 2

CARRIER GAS: N_2 or He, 30 mL/min

COLUMN: Table 2; alternates are SP-2100,
SP-2100 with 0.1% Carbowax 1500
or DB-1 fused silica capillary column

CALIBRATION: solutions of analyte in CS_2 with [illegible]

RANGE: Table 2

ESTIMATED LOD: 0.01 mg per sample [2]

PRECISION (s_r): see EVALUATION OF METHOD [1]

APPLICABILITY: This method uses a simple desorption and can be used for simultaneous analysis of two or more substances suspected to be present by changing the gas chromatographic conditions (i.e., temperature programmed). High humidity during sampling will prevent organic vapors from being trapped efficiently on the sorbent and greatly decreases breakthrough volume.

INTERFERENCES: None identified. The chromatographic column or separation conditions may be changed to circumvent interference problems.

OTHER METHODS: This method combines and replaces Methods P&CAM 127 [3]; S95, S101, S110, S113, S114, S115, S122, S123 and S133 [4]; and S135, S281, S314, S328 and S351 [5].

- a. Remove and discard back sorbent section of a media blank sampler.
- b. Inject a known amount of analyte or calibration stock solution directly onto front sorbent section with a microliter syringe.
- c. Cap the tube. Allow to stand overnight.
- d. Desorb (steps 5 through 7) and analyze together with working standards (steps 11 and 12).
- e. Prepare a graph of DE vs. mg analyte recovered.

10. Analyze three quality control blind spikes and three analyst spikes to insure that the calibration graph and DE graph are in control.

MEASUREMENT:

11. Set gas chromatograph according to manufacturer's recommendations and to conditions given on page 1003-1. Inject sample aliquot manually using solvent flush technique or with autosampler.
    NOTE: If peak area is above the linear range of the working standards, dilute with eluent, reanalyze and apply the appropriate dilution factor in calculations.
12. Measure peak area. Divide the peak area of analyte by the peak area of internal standard on the same chromatogram.

CALCULATIONS:

13. Determine the mass, mg (corrected for DE) of analyte found in the sample front (W_f) and back (W_b) sorbent sections, and in the average media blank front (B_f) and back (B_b) sorbent sections.
    NOTE: If $W_b > W_f/10$, report breakthrough and possible sample loss.
14. Calculate concentration, C, of analyte in the air volume sampled, V (L):

$$C = \frac{(W_f + W_b - B_f - B_b) \cdot 10^3}{V}, \text{ mg/m}^3.$$

EVALUATION OF METHOD:

Laboratory testing was performed with spiked samples and generated atmosphere [1]. All analytes are stable at least one week. All methods were validated using SKC Lot 105 coconut shell charcoal. Results were:

[9] Criteria for a Recommended Standard...Occupational Exposure to 1,1,1-Trichloroethane, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 76-184 (1976).

[10] Criteria for a Recommended Standard...Occupational Exposure to Carbon Tetrachloride, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 76-133 (1976).

METHOD REVISED BY: G. D. Foley; Y. T. Gagnon; and K. J. Williams, NIOSH/DPSE; methods originally validated under NIOSH Contract CDC-99-74-45.

Compounds	Formula	M.W.; mg/m³ = 1 ppm	Synonyms	OSHA NIOSH [6-10] ACGIH	BP (°C)	VP @ 20 °C	Density (g/mL @ 20 °C)
p-Dichlorobenzene	1,4-$C_6H_4Cl_2$	147.00; 6.01	1,4-dichlorobenzene; CAS #106-46-7	75 ppm — 75 ppm, STEL 110 ppm	174	50 Pa	1.241
1,1-Dichloroethane	CH_3CHCl_2; $C_2H_4Cl_2$	98.96; 4.05	ethylidene chloride; CAS #75-34-3	100 ppm 100 ppm 200 ppm, STEL 250 ppm	57	24.3 kPa	1.174
1,2-Dichloroethylene	ClCH=CHCl; $C_2H_4Cl_2$	96.95; 3.96	acetylene dichloride; 1,2-dichloroethene; CAS #540-59-0	200 ppm 200 ppm 200 ppm, STEL 250 ppm	60 (cis) 47 (trans)	24-35 kPa	1.28
Ethylene dichloride*	$ClCH_2CH_2Cl$; $C_2H_4Cl_2$	98.96; 4.05	1,2-dichloroethane; CAS #107-06-2	50 ppm, C 100 ppm 5 ppm; 15 ppm/15 min 10 ppm, STEL 15 ppm	83	8.3 kPa	1.255
Hexachloroethane*	CCl_3CCl_3; C_2Cl_6	236.74; 9.68	perchloroethane; CAS #67-72-1	1 ppm (skin) 1 ppm (skin) 10 ppm	187 (sublimes)	30 Pa	2.09
Methylchloroform	CH_3CCl_3; $C_2H_3Cl_3$	133.42; 5.45	1,1,1-trichloroethane; CAS #71-55-6	350 ppm 350 ppm/15 min CAS #71-55-6 STEL 450 ppm	74 350 ppm,	13.3 kPa	1.335
Propylene dichloride	$CH_3CHClCH_2Cl$; $C_3H_6Cl_2$	112.99; 4.62	1,2-dichloropropane CAS #78-87-5	75 ppm 75 ppm 75 ppm, STEL 110 ppm	95	5.3 kPa	1.156 (25 °C)

*Suspect carcinogen.

	Sampling			Measurement				
	Air Sample Volume (L)					t (°C)		
Compound	Min	Max	Breakthrough in [illegible] air	Working Range (mg/m³)	Column*	Column Injector Detector	Internal Standard	Range (mg per sample)
1,1-Dichloroethane	1 @ 100 ppm	10	18.3 [illegible]3 mg/m³	40 to 1215 (10 L)	A	50 100 175	--	0.4 to 12
1,2-Dichloroethylene	0.5 @ 200 ppm	3	5.4 [illegible]09 mg/m³	80 to 2370 (3 L)	A	60 170 210	---	0.2 to 7
Ethylene dichloride	1 @ 50 ppm	10	29 L [illegible] mg/m³	40 to 1215 (3 L)	A	70 225 250	octane	0.1 to 4
Hexachloroethane	1 @ 1 ppm	10	43 [illegible] mg/m³	1 to 30 (10 L)	D	110 170 210	n-tridecane	0.01 to 0.3
Methylchloroform	0.5 @ 350 ppm	6	9.5 [illegible]08 mg/m³	190 to 5700 (3 L)	A	70 225 250	octane	0.6 to 17
Propylene dichloride	1 @ 75 ppm	10	18 L [illegible] mg/m³	35 to 1050 (10 L)	A	80 170 210	n-undecane	0.3 to 10

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*A = 3 m x 3 mm stainless steel, 10% SP-1000 [illegible]00 mesh Supelcoport;
B = 6 m x 3 mm, otherwise [illegible]e same as A;
C = 3 m x 3 mm stainless steel, 10% OV-101 [illegible]20 mesh Supelcoport; or
D = 3 m x 6 mm glass, [illegible] SP-2250 on 80/100 [illegible]elcoport.

Trichloroethylene

Analyte:	Trichloroethylene	Method No.:	S336
Matrix:	Air	Range:	519-2176 mg/cu m
OSHA Standard:	200 ppm (1075 mg/cu m)-Ceiling 100 ppm (535 mg/cu m)-T.W.A.	Precision $(\overline{CV}_T)$:	0.082
Procedure:	Adsorption on charcoal, desorption with carbon disulfide, GC	Validation Date:	6/6/75

1. Principle of the Method

1.1 A known volume of air is drawn through a charcoal tube to trap the organic vapors present.

1.2 The charcoal in the tube is transferred to a small, stoppered sample container and the analyte is desorbed with carbon disulfide.

1.3 An aliquot of the desorbed sample is injected into a gas chromatograph.

1.4 The area of the resulting peak is determined and compared with areas obtained from injection of standards.

2. Range and Sensitivity

2.1 This method was validated over the range of 519-2176 mg/cu m at an atmospheric temperature and pressure of 24.5°C and 759.4 mm Hg, using a 3-liter sample. Under the conditions of sample size (3 liters) the probable useful range of this method is 108-3225 mg/cu m at a detector sensitivity that gives nearly full deflection on the strip chart recorder for a 9.7 mg sample. This method is capable of measuring much smaller amounts if the desorption efficiency is adequate. Desorption efficiency must be determined over the range used.

2.2 The upper limit of the range of the method is dependent on the adsorptive capacity of the charcoal tube. This capacity varies with the concentrations of analyte and other substances in the air. The first section of the charcoal tube was found to hold 42 mg of analyte when a test atmosphere containing 2266 mg/cu m of analyte in air was sampled at 0.187 liters per minute for 99 minutes; breakthrough was observed at this time, i.e. the concentration of analyte in the effluent was 5% of that in the influent.

(The charcoal tube consists of two sections of activated charcoal separated by a section of urethane foam. See Section 6.2). If a particular atmosphere is suspected of containing a large amount of contaminant, a smaller sampling volume should be taken.

3. Interference

3.1 When the amount of water in the air is so great that condensation actually occurs in the tube, organic vapors will not be trapped efficiently. Preliminary experiments using toluene indicate that high humidity severely decreases the breakthrough volume.

3.2 When two or more compounds are known or suspected to be present in the air, such information, including their suspected identities, should be transmitted with the sample.

3.3 It must be emphasized that any compound which has the same retention time as the analyte at the operating conditions described in this method is an interference. Retention time data on a single column cannot be considered as proof of chemical identity.

3.4 If the possibility of interference exists, separation conditions (column packing, temperature, etc.) must be changed to circumvent the problem.

4. Precision and Accuracy

4.1 The Coefficient of Variation ($\overline{CV}_T$) for the total analytical and sampling method in the range of 519-2176 mg/cu m was 0.082. This value corresponds to an 88.2 mg/cu m standard deviation at the OSHA standard level. Statistical information and details of the validation and experimental test procedures can be found in Reference 11.2.

4.2 On the average the concentrations obtained at the OSHA standard level using the overall sampling and analytical method were 6.4 % lower than the "true" concentrations for a limited number of laboratory experiments. Any difference between the "found" and "true" concentrations may not represent a bias in the sampling and analytical method, but rather a random variation from the experimentally determined "true" concentration. Therefore, no recovery correction should be applied to the final result.

These data are based on validation experiments using the internal standard method.

5. Advantages and Disadvantages of the Method

5.1 The sampling device is small, portable, and involves no liquids. Interferences are minimal, and most of those which do occur can be eliminated by altering chromatographic conditions. The tubes are analyzed by means of a quick, instrumental method.

The method can also be used for the simultaneous analysis of two or more substances suspected to be present in the same sample by simply changing gas chromatographic conditions from isothermal to a temperature-programmed mode of operation.

5.2 One disadvantage of the method is that the amount of sample which can be taken is limited by the number of milligrams that the tube will hold before overloading. When the sample value obtained for the backup section of the charcoal tube exceeds 25% of that found on the front section, the possibility of sample loss exists.

5.3 Furthermore, the precision of the method is limited by the reproducibility of the pressure drop across the tubes. This drop will affect the flow rate and cause the volume to be imprecise, because the pump is usually calibrated for one tube only.

6. Apparatus

6.1 A calibrated personal sampling pump whose flow can be determined within ±5% at the recommended flow rate. (Reference 11.3).

6.2 Charcoal tubes: glass tube with both ends flame sealed, 7 cm long with a 6-mm O.D. and a 4-mm I.D., containing 2 sections of 20/40 mesh activated charcoal separated by a 2-mm portion of urethane foam. The activated charcoal is prepared from coconut shells and is fired at 600°C prior to packing. The adsorbing section contains 100 mg of charcoal, the backup section 50 mg. A 3-mm portion of urethane foam is placed between the outlet end of the tube and the backup section. A plug of silylated glass wool is placed in front of the adsorbing section. The pressure drop across the tube must be less than one inch of mercury at a flow rate of 1 liter per minute.

6.3 Gas chromatograph equipped with a flame ionization detector.

6.4 Column (10-ft x 1/8-in stainless steel) packed with 10% OV-101 stationary phase on 100/120 mesh Supelcoport.

6.5 An electronic integrator or some other suitable method for measuring peak areas.

6.6 Two-milliliter sample containers with glass stoppers or Teflon-lined caps. If an automatic sample injector is used, the associated vials may be used.

6.7 Microliter syringes: 10-microliter, and other convenient sizes for making standards.

6.8 Pipets: 1.0 ml type graduated in 0.1-ml increments.

6.9 Volumetric flasks: 10-ml or convenient sizes for making standard solutions.

7. Reagents

7.1 Chromatographic quality carbon disulfide.

7.2 Trichloroethylene, reagent grade

7.3 Octane, or other suitable internal standard

7.4 Purified nitrogen

7.5 Prepurified hydrogen.

7.6 Filtered compressed air.

8. Procedure

8.1 Cleaning of equipment. All glassware used for the laboratory analysis should be detergent washed and thoroughly rinsed with tap water and distilled water.

8.2 Calibration of Personal Pumps. Each personal pump must be calibrated with a representative charcoal tube in the line. This will minimize errors associated with uncertainties in the sample volume collected.

8.3 Collection and Shipping of Samples

8.3.1 Immediately before sampling, break the ends of the tube to provide an opening at least one-half the internal diameter of the tube (2 mm).

8.3.2 The smaller section of charcoal is used as a back-up and should be positioned nearest the sampling pump.

8.3.3 The charcoal tube should be placed in a vertical direction during sampling to minimize channeling through the charcoal.

8.3.4 Air being sampled should not be passed through any hose or tubing before entering the charcoal tube.

8.3.5 At the ceiling and peak concentrations, a sample size of 3 liters is recommended. Sample for 15 minutes at a flow of 0.2 liters per minute. At the T.W.A. concentration, a sample size of 10 liters is recommended. Sample at a flow of 0.2 liters per minute or less. The flow rates should be known with an accuracy of at least ±5%.

8.3.6 The temperature and pressure of the atmosphere being sampled should be recorded. If pressure reading is not available, record the elevation.

8.3.7 The charcoal tubes should be capped with the supplied plastic caps immediately after sampling. Under no circumstances should rubber caps be used.

8.3.8 One tube should be handled in the same manner as the sample tube (break, seal, and transport), except that no air is sampled through this tube. This tube should be labeled as a blank.

8.3.9 Capped charcoal tubes should be packed tightly and padded before they are shipped to minimize tube breakage during shipping.

8.3.10 A sample of the bulk material should be submitted to the laboratory in a glass container with a Teflon-lined cap. This sample should not be transported in the same container as the charcoal tubes.

8.4 Analysis of Samples

8.4.1 Preparation of Samples. In preparation for analysis, each charcoal tube is scored with a file in front of the first section of charcoal and broken open. The glass wool is removed and discarded. The charcoal in the first (larger) section is transferred to a 2-ml stoppered sample container. The separating section of foam is removed and discarded; the second section is transferred to another stoppered container. These two sections are analyzed separately.

8.4.2 Desorption of Samples. Prior to analysis, 1.0 ml of carbon disulfide is pipetted into each sample container. (All work with carbon disulfide should be performed in a hood because of its high toxicity.) Desorption should be done for 30 minutes. Tests indicate that this is adequate if the sample is agitated occasionally during this period. If an automatic sample injector is used, the sample vials should be capped as soon as the solvent is added to minimize volatilization. For the internal standard method, desorb using 1.0 ml of carbon disulfide containing a known amount of the chosen internal standard.

8.4.3 GC Conditions. The typical operating conditions for the gas chromatograph are:

1. 30 ml/min (60 psig) Nitrogen carrier gas flow
2. 35 ml/min (25 psig) Hydrogen gas flow to detector
3. 400 ml/min (60 psig) Air flow to detector
4. 225°C injector temperature
5. 250°C manifold temperature (detector)
6. 70°C column temperature

8.4.4 Injection. The first step in the analysis is the injection of the sample into the gas chromatograph. To eliminate difficulties arising from blow back or distillation within the syringe needle, one should employ the solvent flush injection technique. The 10-microliter syringe is first flushed with solvent several times to wet the barrel and plunger. Three microliters of solvent are drawn into the syringe to increase the accuracy and reproducibility of the injected sample volume. The needle is removed from the solvent, and the plunger is pulled back about 0.2 microliter to separate the solvent flush from the sample with a pocket of air to be used as a marker. The needle is then immersed in the sample, and a 5-microliter aliquot is withdrawn, taking into consideration the volume of the needle, since the sample in the needle will be completely injected. After the needle is removed from the sample and prior to injection, the plunger is pulled back 1.2 microliters to minimize evaporation of the sample from the tip of the needle. Observe that the sample occupies 4.9-5.0 microliters in the barrel of the syringe. Duplicate injections of each sample and standard should be made. No more than a 3% difference in area is to be expected. An automatic sample injector can be used if it is shown to give reproducibility at least as good as the solvent flush technique.

8.4.5 Measurement of area. The area of the sample peak is measured by an electronic integrator or some other suitable form of area measurement, and preliminary results are read from a standard curve prepared as discussed below.

8.5 Determination of Desorption Efficiency

8.5.1 Importance of determination. The desorption efficiency of a particular compound can vary from one laboratory to another and also from one batch of charcoal to another. Thus, it is necessary to determine at least once the percentage of the specific compound that is removed in the desorption process, provided the same batch of charcoal is used.

8.5.2 Procedure for determining desorption efficiency. Activated charcoal equivalent to the amount in the first section of the sampling tube (100 mg) is measured into a 2.5 in, 4-mm I.D. glass tube, flame sealed at one end. This charcoal must be from the same batch as that used in obtaining the samples and can be obtained from unused charcoal tubes. The open end is capped with Parafilm. A known amount of the analyte is injected directly into the activated charcoal with a microliter syringe, and the tube is capped with more Parafilm. When using an automatic sample injector, the sample injector vials, capped with Teflon-faced septa, may be used in place of the glass tubes.

Six tubes at each of three concentration levels (0.5X,1X and 2X of the standard) are prepared by adding an amount of analyte equivalent to that present in a 3-liter sample at the selected level. The tubes are allowed to stand for at least overnight to assure complete adsorption of the analyte onto the charcoal. These tubes are referred to as the samples. A parallel blank tube should be treated in the same manner except that no sample is added to it. The sample and blank tubes are desorbed and analyzed in exactly the same manner as the sampling tube described in Section 8.4.

Two or three standards are prepared by injecting the same volume of compound into 1.0 ml of carbon disulfide with the same syringe used in the preparation of the samples. These are analyzed with the samples.

If the internal standard method is used, prepare calibration standards by using 1.0 ml of carbon disulfide containing a known amount of the internal standard.

The desorption efficiency (D.E.) equals the average weight in mg recovered from the tube divided by the weight in mg added to the tube, or

$$\text{D.E.} = \frac{\text{Average Weight (mg) recovered}}{\text{Weight (mg) added}}$$

The desorption efficiency is dependent on the amount of analyte collected on the charcoal. Plot the desorption efficiency versus weight of analyte found. This curve is used in Section 10.4 to correct for adsorption losses.

9. Calibration and Standards

It is convenient to express concentration of standards in terms of mg per 1.0 ml carbon disulfide, because samples are desorbed in this amount of carbon disulfide. The density of the analyte is used to convert mg into microliters for easy measurement with a microliter syringe. A series of standards, varying in concentration over the range of interest, is prepared and analyzed under the same GC conditions and during the same time period as the unknown sample. Curves are established by plotting concentration in mg per 1.0 ml versus peak area.

For the internal standard method, use carbon disulfide containing a predetermined amount of the internal standard. The internal standard concentration used was approximately 70% of the concentration at 2X the standard. The analyte concentration in mg per ml is plotted versus the area ratio of the analyte to that of the internal standard. Note: Whether the external standard or internal standard method is used, standard solutions should be analyzed at the same time the sample analysis is done. This will minimize the effect of variations in FID response.

10. Calculations

10.1 Read the weight, in mg, corresponding to each peak area from the standard curve. No volume corrections are needed, because the standard curve is based on mg per 1.0 ml carbon disulfide and the volume of sample injected is identical to the volume of the standards injected.

10.2 Corrections for the blank must be made for each sample.

$$\text{mg} = \text{mg sample} - \text{mg blank}$$

where:

mg sample = mg found in front section of sample tube
mg blank = mg found in front section of blank tube

A similar procedure is followed for the backup sections.

10.3 Add the amounts present in the front and backup sections of the same sample tube to determine the total weight in the sample.

10.4 Read the desorption efficiency from the curve (see Section 8.5.2) for the amount found in the front section. Divide the total weight by this desorption efficiency to obtain the corrected mg/sample.

$$\text{Corrected mg/sample} = \frac{\text{Total weight}}{\text{D.E.}}$$

10.5 The concentration of the analyte in the air sampled can be expressed in mg per cu m.

$$\text{mg/cu m} = \frac{\text{Corrected mg (Section 10.4)} \times 1000 \text{ (liters/cu m)}}{\text{Air Volume Sampled (liters)}}$$

10.6 Another method of expressing concentration is ppm (corrected to standard conditions of 25°C and 760 mm Hg).

$$\text{ppm} = \text{mg/cu m} \times \frac{24.45}{\text{MW}} \times \frac{760}{P} \times \frac{(T + 273)}{298}$$

where:

P = pressure (mm Hg) of air sampled
T = temperature (°C) of air sampled
24.45 = molar volume (liter/mole) at 25°C and 760 mm Hg
MW = molecular weight
760 = standard pressure (mm Hg)
298 = standard temperature (°K)

11. References

11.1 White, L.D. et al, "A Convenient Optimized Method for the Analysis of Selected Solvent Vapors in the Industrial Atmosphere," Amer. Ind. Hyg. Assoc. J., 31: 225 (1970).

11.2 Documentation of NIOSH Validation Tests, NIOSH Contract No. CDC-99-74-45.

11.3 Final Report, NIOSH Contract HSM-99-71-31, "Personal Sampler Pump for Charcoal Tubes," September 15, 1972.

FORMULA: $CH_2{=}CHCl$; C_2H_3Cl

M.W.: 62.50

VINYL CHLORIDE

METHOD: 1007
ISSUED: 2/15/84

OSHA: 1 ppm; C 5 ppm
NIOSH: minimum measurable
ACGIH: 5 ppm (human carcinogen) [1]
(1 ppm = 2.56 mg/m³ @ NTP)

PROPERTIES: BP -14 °C; vapor density 2.2 (air = 1)

SYNONYMS: chloroethylene; chloroethene; CAS #75-01-4.

SAMPLING

SAMPLER: SOLID SORBENT TUBE
(2 tandem tubes, each with 150 mg activated coconut charcoal)

FLOW RATE: 0.05 L/min

VOL-MIN: 0.7 L
-MAX: 5 L

SHIPMENT: separate primary and backup tubes and cap each

SAMPLE STABILITY: 10 days @ 25 °C

BLANKS: 2 to 10 field blanks per set

ACCURACY

RANGE STUDIED: 1 to 64 mg/m³ [2]

BIAS: -6% of calculated concentration [2]

OVERALL PRECISION (s_r): 0.06 [2]

MEASUREMENT

TECHNIQUE: GAS CHROMATOGRAPHY, FID

ANALYTE: vinyl chloride

DESORPTION: 1 mL carbon disulfide; 30 min

INJECTION ALIQUOT: 5 µL

COLUMN: stainless steel, 6.1 m x 3.2 mm, 10% SE-30 on 80/100 mesh Chromosorb W (AW-DMCS)

CARRIER GAS: He, 40 mL/min

TEMPERATURE-INJECTOR: 230 °C
-DETECTOR: 230 °C
-COLUMN: 60 °C

CALIBRATION: solutions of vinyl chloride in CS_2

RANGE: 0.002 to 0.2 mg per sample [2]

ESTIMATED LOD: 0.00004 mg per sample [2]

PRECISION (s_r): not determined

APPLICABILITY: The working range is 0.4 to 40 mg/m³ (0.16 to 16 ppm) for a 5-L air sample. The method is applicable to 15-min samples at concentrations of 1 ppm or higher.

INTERFERENCES: Other than the possibility of loss of sample upon storage of two weeks or more at room temperature, none have been noted.

OTHER METHODS: This is a revision of P&CAM 178 [3].

MEASUREMENT:

12. Set the gas chromatogrph according to manufacturer's instructions and to conditions given on page 1007-1. Inject sample aliquot manually using solvent flush technique or with autosampler. The retention time of vinyl chloride is about 1.7 min.
    NOTE: If peak area is above the linear range of the working standards, dilute with CS_2, reanalyze and apply the appropriate dilution factor in calculations.
13. Measure peak area.

CALCULATIONS:

14. Determine the mass, mg (corrected for DE) of vinyl chloride found in the sample front (W_f) and back (W_b) tubes, and in the average media blank (B).
    NOTE: If $W_b > W_f/10$, report breakthrough and possible sample loss.
15. Calculate concentration, C, of vinyl chloride in the air volume sampled, V (L):

$$C = \frac{(W_f + W_b - 2B) \cdot 10^3}{V}, \text{ mg/m}^3$$

EVALUATION OF METHOD:

The method was evaluated using single 150-mg sampling tubes with 100-mg front beds and 50-mg back beds [2]. At four concentrations between 1 and 64 mg/m³, the pooled relative standard deviation was 0.06 and the measurements averaged 94% of the concentrations calculated from the volumes of vinyl chloride and air used for the atmospheres sampled; samples at the 3-µg level showed no loss of vinyl chloride when stored for 12 days at room temperature or 19 days at -20 °C. There may be significant loss of vinyl chloride from samples stored for 14 days at room temperature [4]. The 1% breakthrough capacity for a 150-mg bed of coconut charcoal challenged at 100 mL/min with vinyl chloride in air at 16 mg/m³ and a relative humidity of 70% was 4.6 L [5].

REFERENCES:

[1] TLVs - Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment with Intended Changes for 1983-84, ACGIH, Cincinnati, OH (1983).
[2] Hill, R. H., Jr., C. S. McCammon, A. T. Saalwaechter, A. W. Teass, and W. J. Woodfin. Anal. Chem., 48, 1395-1398 (1976).
[3] NIOSH Manual of Analytical Methods, 2nd. ed., V. 1, P&CAM 178, U.S. Department of Health and Human Services, Publ. (NIOSH) 77-157-A (1977).
[4] Cuddeback, J. E., W. R. Burg, and S. R. Birch, Environ. Sci. Technol., 9, 1168-1171 (1975).
[5] Matsumura, Y. Ind. Health, 18, 61-67 (1980).

METHOD REVISED BY: A. W. Teass, Ph.D., NIOSH/DPSE.

REAGENTS:

1. Carbon disulfide,* chromatographic quality.
2. Vinyl chloride,*, 99.9%, in lecture bottle fitted with valve and septum.
3. Calibration stock solution, 0.26 mg/mL.
   a. Insert the tip of a gas syringe containing 1 mL vinyl chloride gas under the surface of 5 mL CS_2 in a 10-mL volumetric flask.
   b. Open the valve of the syringe and withdraw the plunger to pull CS_2 into the barrel. (As vinyl chloride dissolves, a vacuum will be created, pulling CS_2 into the syringe.)
   c. Push the solution from the syringe into the flask. Rinse the syringe twice with 1-mL portions of CS_2 and add the washings to the flask.
   d. Dilute to the mark with CS_2.
4. Helium, purified.
5. Hydrogen, purified.
6. Air, filtered.

*See Special Precautions.

EQUIPMENT:

1. Sampler: two tandem glass tubes, 7 cm long, 6 mm OD, 4 mm ID, flame-sealed ends, each containing 150 mg of 20/40 mesh activated (600 °C) coconut shell charcoal. A silylated glass wool plug precedes the charcoal beds and a 3-mm urethane foam plug follows the charcoal beds. Plastic caps are included for sealing after use. Pressure drop across each tube at 1 L/min airflow must be less than 3.4 kPa.
   NOTE: A pair of two-section (100 mg/50 mg) tubes may be used.
2. Personal sampling pump, 0.05 L/min, with flexible connecting tubing.
3. Gas chromatograph, flame ionization detector, integrator and column (page 1007-1).
4. File.
5. Bent wire for removing plugs from sampling tube.
6. Vials, 2-mL, glass with PTFE-lined septa and crimp-on seals.
7. Volumetric flasks, 10-mL, with polyethylene stoppers.
8. Pipettes, delivery, 1.0-mL, graduated in 0.1-mL increments, 2- and 5-mL, with pipet bulb.
9. Air sampling bags, Tedlar, 10-L.
10. Gas syringe, with gas-tight valve, 0.1- and 1-mL.
11. Syringe, 10-µL, with 0.1-µL graduations.

SPECIAL PRECAUTIONS: Carbon disulfide is toxic and an acute fire and explosion hazard (flash point = -30 °C); work with it only in a hood.

Vinyl chloride is a human carcinogen [1].

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Break the ends of the tubes immediately before sampling. Attach two tubes, with ends touching, with a short piece of tubing. Label one tube as the back tube and insert the back tube into the flexible tubing attached to the personal sampling pump.
3. Sample at 0.05 L/min for 15 to 100 min. Do not sample more than 5 L of air.
4. Separate the primary and backup tubes and cap each tube for shipment.

SAMPLE PREPARATION:

5. Add 1.0 mL CS_2 to an empty vial. Loosely cap the vial.
6. Score each sampler tube with a file in front of the glass wool plug. Break the tube at the score line.

7. Transfer the charcoal from the front and back tubes to separate vials. Discard the glass wool and foam plugs. Seal the vials with septum caps immediately.
8. Allow to stand for 30 min, with occasional agitation. Analyze the sample within the next 30-min period.

CALIBRATION AND QUALITY CONTROL:

9. Calibrate with at least five working standards covering the range 0.0002 to 0.2 mg per sample.
   a. Add known amounts of calibration stock solution to CS_2 in 10-mL volumetric flasks and dilute to the marks, using serial dilution as appropriate.
      NOTE: Working standards can be stored at -20 °C for at least three days.
   b. Analyze together with samples and blanks (steps 12 and 13).
   c. Prepare calibration graphs of peak area vs. quantity (mg) of vinyl chloride per tube and peak area vs. quantity (ng) per injection.
10. Determine desorption efficiency (DE) at least once for each lot of charcoal used in the calibration range (step 9). Prepare three tubes at each of five levels plus three media blanks.
    a. Prepare three atmospheres of vinyl chloride in air by injecting 0.01, 0.08, and 0.2 mL vinyl chloride gas into 10 L air in Tedlar bags. The resulting concentrations are approximately 2.6, 21 and 52 mg/m³.
    b. Following steps 1 through 4, sample these atmospheres according to the following scheme:

Concentration in Bag (mg/m³)	Volume Sampled (L)	Quantity of Vinyl Chloride (mg)
2.6	0.8	0.002
	2.2	0.006
21	0.8	0.017
	2.2	0.046
52	2.5	0.13

    Obtain three samples at each level.
    c. Desorb (steps 6 through 8) and analyze together with working standards (steps 12 and 13). No vinyl chloride should be found on the back tubes.
    d. Analyze the atmospheres in the bags (steps 12 and 13) using 1-mL gas samples. Read from the calibration graph the quantity (ng) per injection, which for a 1-mL injection of gas is numerically equal to the concentration in mg/m³.
    e. Calculate DE from the mass (mg) of vinyl chloride on the front tube (W_f), the average blank (B), the concentration of vinyl chloride in the synthetic atmospheres (C_s, mg/m^3), and the volume of air sampled (V, L):

$$DE = \frac{(W_f - B) \cdot 10^3}{(C_s)(V)}$$

    f. Prepare a graph of DE vs. mass found (W_f - B).
11. Analyze three quality control blind spikes and three analyst spikes to ensure that the calibration graph and DE graph are in control.

VELSICOL CHEMICAL CORPORATION
ST. LOUIS, MICHIGAN
PROJECT Nº 1524

GAS VENT SAMPLING

DATE OF COLLECTION		SAMPLER		BAROMETRIC PRESSURE									
TEMPERATURE		RELATIVE HUMIDITY		GAUGE	1	2	3	4	5	6	7	8	9	10	11
CHARCOAL LOT Nº		TENAX LOT Nº		READING											

GAS VENT NUMBER	PUMP NUMBER	SAMPLE NUMBER	SAMPLING TIME			SAMPLING RATE (cc/min.)	SAMPLE VOLUME (ℓ)
			START	FINISH	ELAPSED		
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
DUPLICATE							
BLANK							

DATE OF SAMPLE SHIPMENT	METHOD OF SHIPMENT

COMMENTS

VELSICOL CHEMICAL CORPORATION
ST. LOUIS, MICHIGAN
PROJECT Nº 1524

GAS VENT SAMPLING PUMPS CALIBRATION LOG

DATE

CALIBRATED BY

PUMP NUMBER	PUMP TYPE	BEFORE SAMPLING						AFTER SAMPLING					AVERAGE			
		TEMP. (°F)	HUMIDITY (%)	BAROM. PRESSURE (Inches Hg)	INITIAL FLOW (cc/min.)	CAL. FLOW (cc/min.)	24-HR. TIME	TEMP. (°F)	HUMIDITY (%)	BAROM. PRESSURE (Inches Hg)	FLOW (cc/min.)	24-HR. TIME	TEMP. (°F)	HUMIDITY (%)	BAROM. PRESSURE (Inches Hg)	FLOW (cc/min.)

COMMENTS

SHEET ___ OF ___

# CHAIN OF CUSTODY RECORD	PROJECT Nº. 1524	PROJECT NAME: GAS VENT MONITORING PLANT SITE ST. LOUIS, MICHIGAN	VELSICOL CHEMICAL CORPORATION 701 W. WASHINGTON STREET ST. LOUIS, MICHIGAN 48880

SAMPLER'S SIGNATURE ______________________ (SIGN)

SAMPLE Nº	SEQ Nº	DATE	TIME	FRONT / REAR	TENAX / CHARCOAL	SAMPLE TYPE	Nº OF CONTAINERS	REMARKS
						TOTAL Nº. OF CONTAINERS ———		

RELINQUISHED BY: 1 ________ (SIGN)	DATE/TIME	RECEIVED BY: ② ________ (SIGN)	RELINQUISHED BY: 2 ________ (SIGN)	DATE / TIME	RECEIVED BY: ③ ________ (SIGN)
RELINQUISHED BY: 3 ________ (SIGN)	DATE/TIME	RECEIVED BY: ④ ________ (SIGN)	RELINQUISHED BY: 4 ________ (SIGN)	DATE/TIME	RECEIVED BY: ⑤ ________ (SIGN)
RELINQUISHED BY: 5 ________ (SIGN)	DATE/TIME	RECEIVED BY: ⑥ ________ (SIGN)	RELINQUISHED BY: 6 ________ (SIGN)	DATE / TIME	RECEIVED BY: ⑦ ________ (SIGN)
METHOD OF SHIPMENT:		SHIPPED BY:	RECEIVED FOR LABORATORY: ________ (SIGN)		DATE / TIME

APPENDIX D

WEEKLY INSPECTION LOG SHEET

QUARTERLY INSPECTION LOG SHEET

DEEP WELL SAMPLE ANALYSIS	DAILY LIMITS pH : 4.0 to 10.0 SG : < 1.220 TSS : < 500ppm	ANALYST(S)	**Velsicol Chemical Corporation** 701 W. WASHINGTON STREET ST. LOUIS, MICHIGAN 48880

SAMPLING STATION	

DATE								
TIME								
GENERAL APPEARANCE								
COLOR								
TURBIDITY								
ODOR								
PARTICULATE MATTER								
pH								
SPECIFIC GRAVITY								
TARE FILTERS (g) BLANK (DISTILLED WATER)								
TRIAL Nº 1								
TRIAL Nº 2								
FINAL WEIGHT FILTERS (g) BLANK								
TRIAL Nº 1								
TRIAL Nº 2								
NET WEIGHT FILTER (g) BLANK								
TRIAL Nº 1								
TRIAL Nº 2								
AVERAGE NET WT. (g)								
VOLUME FILTERED (L) BLANK								
TRIAL Nº 1								
TRIAL Nº 2								
CALCULATION OF TSS (ppm)*								

*(AVERAGE NET WEIGHT IN GRAMS/ONE LITRE) x 1000 = TSS (ppm)

DISPOSAL WELL INJECTION LOG

Velsicol Chemical Corporation
500 N. BANKSON STREET
ST. LOUIS, MICHIGAN 48880

DATE	INTEGRATOR		x 140 = GALLONS	TIME		CALCULATED VOLUME	AVERAGE FLOW	OPERATOR INITIAL
	START	STOP		START	STOP			

R 4420 Rev. 6/81
4833-8490

MONTHLY OPERATING REPORT FOR

THIS IS YOUR MONTHLY REPORT FORM FOR DISPOSAL WELL #2

SEE REVERSE SIDE FOR RETURN MAIL

Please complete and submit two copies of this form at the end of each month. This report must reach our Lansing office by the 10th of the month.

	FACILITY NUMBER	PERMIT NUMBER	OUTFALL NUMBER

PART 1 – RETURN TO DEPT OF NATURAL RESOURCES

Date form was printed Yr. Mo. Day

PARAM.					PUMP				WELLHEAD																			
NAME UNITS	FLOW				PRESSURE				PRESSURE				P.H				SG				TSS							
LIMIT	200 GPM				150 PSI				150				4 - 10				<1.220				500 ppm							
DATE	1	DAILY AVG.	HIGH	LOW	1	DAILY AVG.	HIGH	LOW	1	DAILY AVG.	HIGH	LOW	1	DAILY AVG.	HIGH	LOW	1	DAILY AVG.	HIGH	LOW	1	DAILY AVG.	HIGH	LOW	1	DAILY AVG.	HIGH	LOW
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MONTHLY SUMMARY	AVERAGE		AVERAGE		AVERAGE		AVERAGE		AVERAGE		AVERAGE		AVERAGE	
	MAXIMUM		MAXIMUM		MAXIMUM		MAXIMUM		MAXIMUM		MAXIMUM		MAXIMUM	
	NUMBER DAYS REPORTING		NUMBER DAYS REPORTING		NUMBER DAYS REPORTING		NUMBER DAYS REPORTING		NUMBER DAYS REPORTING		NUMBER DAYS REPORTING		NUMBER DAYS REPORTING	
	TOTAL SAMPLES TAKEN		TOTAL SAMPLES TAKEN		TOTAL SAMPLES TAKEN		TOTAL SAMPLES TAKEN		TOTAL SAMPLES TAKEN		TOTAL SAMPLES TAKEN		TOTAL SAMPLES TAKEN	
	DAYS EXCEEDING MAXIMUM		DAYS EXCEEDING MAXIMUM		DAYS EXCEEDING MAXIMUM		DAYS EXCEEDING MAXIMUM		DAYS EXCEEDING MAXIMUM		DAYS EXCEEDING MAXIMUM		DAYS EXCEEDING MAXIMUM	
	AVG. MAX. VIOL.		AVG. MAX. VIOL.		AVG. MAX. VIOL.		AVG. MAX. VIOL.		AVG. MAX. VIOL.		AVG. MAX. VIOL.		AVG. MAX. VIOL.	
BEGINNING DATE			DUP PUNCH (76-80)		DUP PUNCH (76-80)		DUP PUNCH (76-80)		DUP PUNCH (76-80)		DUP PUNCH (76-80)		DUP PUNCH (76-80)	
ENDING DATE		M M D D Y Y												

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED IN THIS DOCUMENT AND ALL ATTACHMENTS AND THAT, BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION, I BELIEVE THAT THE INFORMATION IS TRUE, ACCURATE, AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT.

SIGNATURE OF CERTIFIED OPERATOR ____________ CERTIFICATION NUMBER ____________

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER ____________ TELEPHONE NUMBER ____________

QUARTERLY INSPECTION LOG SHEET
ST. LOUIS MICHIGAN PLANT SITE

INSPECTOR'S NAME/TITLE ______________________________ / ____________

DATE OF INSPECTION ______________________________ (MONTH/DAY/YEAR)

TIME OF INSPECTION ______________________________ (MILITARY TIME)

ITEM	TYPES OF PROBLEMS	STATUS (CHECK) ACCEPTABLE	UNACCEPTABLE	OBSERVATIONS	WORK ORDER NUMBER	DATE AND NATURE OF REPAIRS/ REMEDIAL ACTION
Containment Wall	Sample					
Leachate collection system (Performed twice yearly plus each pumping)	- Height of leachate in sumps - Corrosion, damage to manhole cover - Disintegration, damage to manhole sump top (fracture, cracking, crumbling) - Corrision, damage to manhole steps - Pipes blocked					
Gas Vents	- Sample - Damage to Vents - Corrosion - Gauge					
Pump	- Ruptured, worn seals - Worn bearings - Cracked or worn housing					
Groundwater wells	- Corrosion or damage to well pipes, caps, locks barriers and screens. - Groundwater elevation					
Storage Tank (Twice Yearly)	- Structural Integrity - Solids in tank.					

APPENDIX E

DISPOSAL WELL INJECTION LOGS

WEEKLY INSPECTION LOG SHEET
ST. LOUIS MICHIGAN PLANT SITE

INSPECTOR'S NAME/TITLE ______________________________/__________

DATE OF INSPECTION ______________________________(MONTH/DAY/YEAR)

TIME OF INSPECTION ______________________________(MILITARY TIME)

ITEM	TYPES OF PROBLEMS	STATUS (CHECK) ACCEPTABLE	STATUS (CHECK) UNACCEPTABLE	OBSERVATIONS	WORK ORDER NUMBER	DATE AND NATURE OF REPAIRS/ REMEDIAL ACTION
Perimeter fence	- Corrosion damage to support posts and fence fabric					
Gates & lock	- Corrosion damage to gate hinges and fabric - Locks sticking or corroding					
Signs	- Corrosion, visibility, damage					
*Landscaped cap area	- Areas without vegetative cover - High vegetative cover - Presence of deep rooted vegetative or burrowing mammals - Erosion, cracking - Subsidence (visual) - Settlement - Slumping - Seepage					

* Inspection activities performed bi-weekly on a seasonal basis.

WEEKLY INSPECTION LOG SHEET
ST. LOUIS MICHIGAN PLANT SITE

INSPECTOR'S NAME/TITLE ______________________________ / ______________

DATE OF INSPECTION ______________________________ (MONTH/DAY/YEAR)

TIME OF INSPECTION ______________________________ (MILITARY TIME)

ITEM	TYPES OF PROBLEMS	STATUS (CHECK) ACCEPTABLE	 UNACCEPTABLE	OBSERVATIONS	WORK ORDER NUMBER	DATE AND NATURE OF REPAIRS/ REMEDIAL ACTION
Pumps & Piping	- *Corrosion, leaks					
	- *Excess vibration					
	- *Instrument malfunction					
	- *Liquid sample					
	- *Pressure, flow					
Valves & Locks	- Corrosion					
	- Damage					
	- Lubrication					
Buildings	- Wind damage					
	- Vandalism					
	- Security					
	- Signs					
	- Floor slabs					
Access Road	- ~~P~~Rutting, Ponding, Erosion					
	- Access					

* Performed twice daily during injection.