
Hazardous Waste Ground-Water Task Force

Evaluation of SCA Chemical Services Model City, N.Y.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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UPDATE OF THE HAZARDOUS WASTE GROUND-WATER TASK FORCE EVALUATION OF SCA-CHEMICAL SERVICES INC. MODEL CITY FACILITY

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The United States Environmental Protection Agency's Hazardous Waste Ground-Water Task Force (HWGWTF) in conjunction with the New York State Department of Environmental Conservation (NYSDEC) conducted an evaluation of the ground-water monitoring program at the SCA-Chemical Services Inc., Model City, New York hazardous waste treatment, storage and disposal facility. The SCA-Chemical Services facility is located approximately 10 miles north-east of the city of Niagara Falls, New York. The onsite field inspection was conducted over a two-week period from July 9-24, 1985. SCA Chemical Services is one of 58 facilities that are to be evaluated by the HWGWTF. The purpose of the HWGWTF evaluations is to determine the adequacy of a facility's ground-water monitoring program in regard to the applicable State and Federal ground-water monitoring requirements. The HWGWTF effort came about in light of the recent concerns as to whether operators of hazardous waste treatment, storage and disposal facilities are complying with the State and Federal ground-water monitoring regulations.

The evaluation of the SCA-Chemical Services facility focused on determining (1) if the facility was in compliance with applicable regulatory requirements and policy, (2) if hazardous constituents were present in the ground water and (3) if the presence of hazardous constituents within the facility boundary poses a threat to human health and the environment.

The results of the chemical analysis of ground-water samples collected from existing wells within the facility boundary indicated that there is

currently no threat to public health or the environment as a result of waste handling practices at the facility.

At the time of the inspection, the facility had 41 operating ground-water monitoring wells.. Subsequently, SCA has installed a new monitoring well network around portions of the facility due to anticipated opening of a new unit. The well network monitors ground water in two hydraulically connected permeable zones beneath the facility.

SCA-Chemical Services has, in general, operated in compliance under the NYSDEC operating permit. It was determined that SCA was in compliance with the applicable State interim status ground-water monitoring requirements for certification as required by The Hazardous and Solid Waste Amendments of 1984.

In accordance with the ground-water monitoring regulations, a facility's monitoring system must be capable of immediately detecting a release of hazardous waste constituents from a regulated unit. Under the current precepts concerning ground-water monitoring, the SCA Model City facility must upgrade and improve their ground-water monitoring program in order to fully comply with applicable requirements.

Prior to, and continuing after the facility evaluation, personnel from SCA, NYSDEC and the USEPA have held a series of meetings in order to come to agreement on the design and operation of a new ground-water monitoring system that will fulfill the regulatory requirements for the final operating permit. To date, the parties have resolved most of the issues, concerning the new proposed ground-water monitoring program. However, there are a few remaining issues to be resolved. In response to the remaining issues the NYSDEC has issued a permit modification to the facility establishing a schedule under which the new ground-water

monitoring program must be installed. The permit modification also requires:

1. Determining the extent of any ground-water contamination
2. Determining specific indicator parameters for detecting a release from a regulated unit
3. Defining the specific analytical methods for chemical analysis of the indicator parameters
4. Developing a statistical method to be used to determine the presence of the indicator parameters

The NYSDEC has also issued a complaint and has executed an Order on Consent for violations that were discovered as a result of the facility evaluation. The violations that were encountered are:

1. SCA has failed to obtain ground-water analyses which are adequate to establish background concentrations as set forth in the Maintenance, Monitoring and Contingency Plan (MMCP) of the permit and required by regulation.
2. SCA has failed to perform all of the statistical comparisons of ground-water analyses as set forth in the MMCP and required by regulation.
3. SCA has, without approval from the NYSDEC, implemented a sample filtration procedure which is not in accordance with the procedures set forth in the MMCP, and does not comply with the NYSDEC policy on altering water samples.
4. SCA has violated the criteria set forth in the MMCP defining holding times for samples destined for volatile organic analysis.
5. SCA has violated conditions set forth in the facility operating permit and the MMCP concerning leachate levels in secure landfills 1 through 7 and 10.

Through the order, the NYSDEC assessed and collected fines of \$105,000.00 and established a compliance schedule to be followed by the facility to correct the violations.

This completes the Hazardous Waste Ground-Water Task Force evaluation of the SCA-Chemical Services Inc., Model City facility.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
HAZARDOUS WASTE GROUND-WATER TASK FORCE

EPA-330/2-8-002

GROUND-WATER MONITORING EVALUATION
SCA CHEMICAL SERVICES - MODEL CITY
Model City, New York

April 1986

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INTRODUCTION

Concerns have recently been raised about whether commercial hazardous waste treatment, storage and disposal facilities (TSDFs) are complying with the ground-water monitoring requirements promulgated under the Resource Conservation and Recovery Act (RCRA)*. In question is the ability of existing or proposed ground-water monitoring systems to detect contaminant releases from waste management units. To evaluate these systems and determine the current compliance status, the Administrator of the Environmental Protection Agency (EPA) established a Hazardous Waste Ground-water Task Force (Task Force). The Task Force comprises personnel from the EPA Office of Solid Waste and Emergency Response (OSWER), National Enforcement Investigations Center (NEIC), Regional Offices and State regulatory agencies. The Task Force is conducting in-depth onsite investigations of commercial TSDFs with the following objectives:

- Determine compliance with interim status ground-water monitoring requirements of 40 CFR Part 265 as promulgated under RCRA or the State equivalent (where the State has received RCRA authorization)
- Evaluate the ground-water monitoring program described in the facility's RCRA Part B permit application for compliance with 40 CFR Part 270.14(c)
- Determine if the ground water at the facility contains hazardous waste constituents
- Provide information to assist the Agency in determining if the TSDF meets EPA ground-water monitoring requirements for waste management facilities receiving waste from response actions conducted under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, Public Law 91-510)**

* Regulations promulgated under RCRA address hazardous waste management facility operations, including ground-water monitoring, to ensure that hazardous waste constituents are not released to the environment.

** EPA policy, stated in May 6, 1985 memorandum from Jack McGraw on "Procedures for Planning and Implementing Off-site Response", requires that TSDFs receiving CERCLA waste be in compliance with applicable RCRA ground-water monitoring requirements.

To address these objectives, each Task Force investigation will determine if:

- The facility has developed and is following an adequate ground-water sampling and analysis plan
- Designated RCRA and/or State-required monitoring wells are properly located and constructed
- Required analyses have been conducted on samples from the designated RCRA monitoring wells
- The ground-water quality assessment program outline (or plan, as appropriate) is adequate

The first TSDF investigated by the Task Force was the SCA Chemical Services, Model City site (SCA), located in Model City, New York, about 10 miles northeast of the city of Niagara Falls [Figure 1]. The onsite inspection was conducted from July 9 through 24, 1985 and was coordinated by personnel from NEIC, a field component of the Office of Enforcement and Compliance Monitoring. In general, the investigation involved review of State, Federal and facility records, facility inspection, laboratory evaluation, and ground-water and landfill leachate sampling and analysis.

The area of and surrounding the current SCA waste management site has been used since the 1940s for a variety of industrial, military and waste-handling activities. In 1942, a portion of the current SCA site was used for trinitrotoluene (TNT) production as part of the 7,000-acre Federal Lake Ontario Ordnance Works. Later, it was part of the Manhattan Project site. The TNT works were closed and mothballed in late 1944. In the 1950s, the Ordnance Works property was subdivided and a portion of the current SCA site was leased by Olin-Matheson, as a Government contractor, for research and development of rocket fuels. An area north of the current SCA facility was used by Bell Aerospace beginning in the 1950s for rocket engine testing. The Department of Energy has operated facilities bordering the south of the SCA site, including a storage area for radioactive waste from Manhattan Project operations.

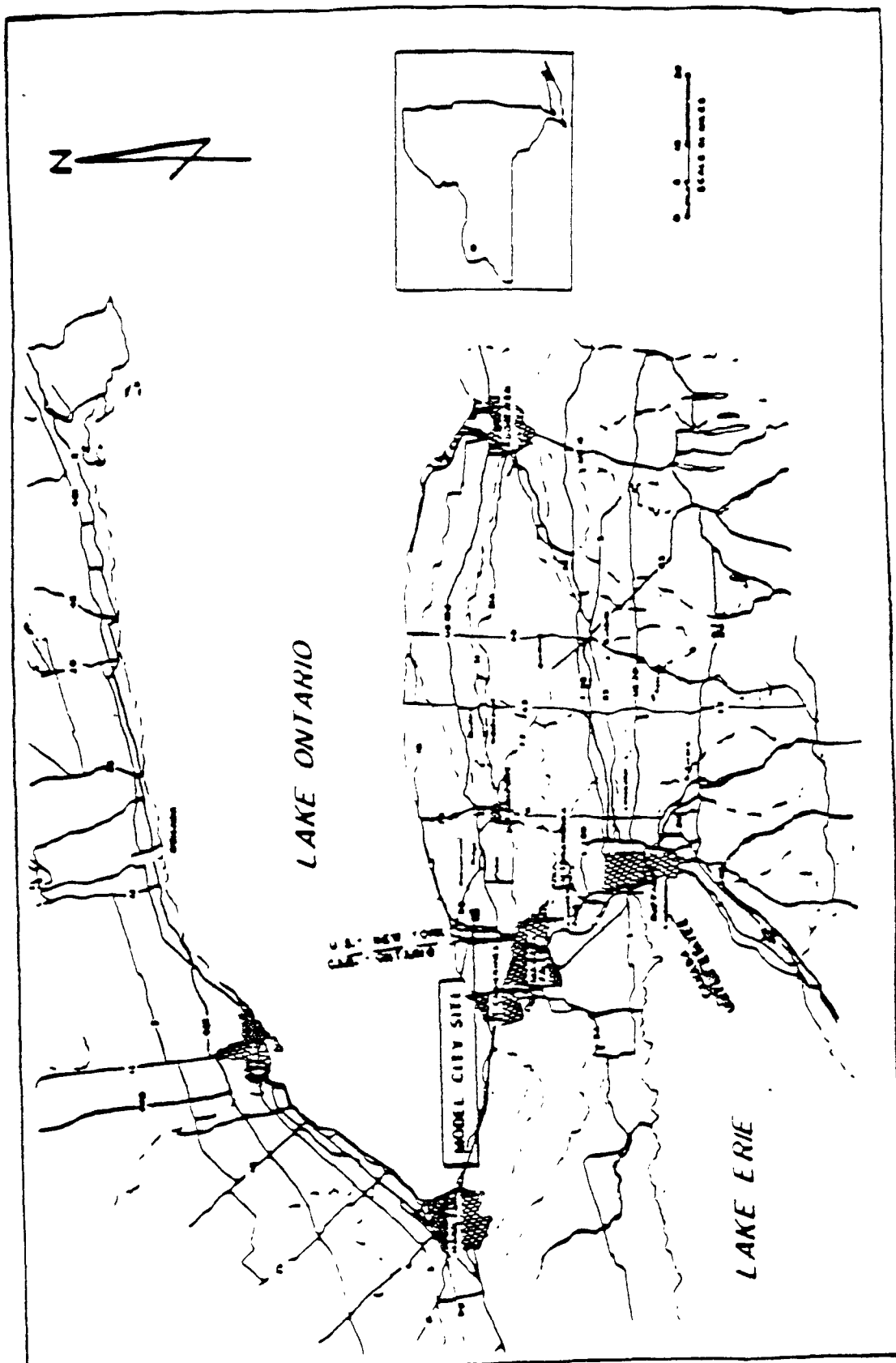


Figure 1.
Model City Location Map
(from Golder Associates)

The current SCA site, which had become contaminated with radioactive materials from these early activities, was partially decontaminated by excavation of "radioactive hot spots" through a joint effort of the Atomic Energy Commission and the New York State Department of Health. Additional decontamination is currently being conducted at the site by the Nuclear Regulatory Agency. Olin-Matheson's rocket fuel program included use of the "Olin burn area", an area on the current SCA facility where rocket fuels and associated waste were reportedly disposed of. A contractor for the U.S. Army Corps of Engineers has been studying this "Olin burn area" to identify any environmental problems associated with past practices.

In the 1960s, the present SCA site was used as a private hunting club. Chem-Trol Pollution Services, Inc. (Chem-Trol) purchased 241 acres of the site in 1971 and in March 1972 began hazardous waste management activities. Initial operations included liquid waste neutralization, a distillation solvent recovery system, thermal waste destruction (incineration) and land-filling. Chem-Trol merged with SCA Chemical Services, Inc. of Boston in October 1973. The facility purchased additional bordering acreage in July 1976, expanding total holdings to about 900 acres. Chemical Waste Management, Inc. (CWM) purchased the facility in September 1984. The Model City facility is currently operated by SCA, a wholly-owned subsidiary of CWM.

The original thermal destruction and solvent recovery systems have been shut down and the liquid waste neutralization system has been expanded into an aqueous waste neutralization/activated carbon/biological treatment process. Landfilling of hazardous waste remains a major waste handling activity at SCA.

SCA first submitted a RCRA Part A permit application to EPA Region II in November 1980 and has since operated under EPA identification number NYD049836679. Prior to New York receiving RCRA Interim Authorization in December 1983, the site was regulated by Federal regulations promulgated under RCRA (Code of Federal Regulations, Title 40, Part 265) and State regulations promulgated under New York Environmental Conservation law (New York Codes, Rules and Regulations, Title 6, Part 360). Under the latter regulations, the New York State Department of Environmental Conservation

(DEC) issued waste management permits to SCA including an overall general operating permit (No. 2343) which regulates construction, operation, monitoring and reporting requirements for all hazardous-waste-related activity at the site. Site permits are listed in Appendix A.

The State-issued general facility operating permit requires that the facility follow specified operating procedures including the requirement that the facility prepare, maintain and follow a State-approved Maintenance, Monitoring and Contingency Plan (MMCP). The MMCP contains details of site air, surface water and ground-water monitoring and reporting requirements.

In addition to the State requirements and permits, which regulate PCBs as hazardous waste, PCBs and PCB items are handled at SCA under Federal regulations promulgated by the Toxic Substances Control Act (TSCA, 40 CFR 761) and PCB disposal approvals issued by EPA, Region II [Appendix B].

Appendix C lists other agreements and State orders which, in some cases, contain additional operating, monitoring and/or reporting requirements for SCA.

SUMMARY OF FINDINGS AND CONCLUSIONS

The findings and conclusions presented in this report reflect conditions existing at the facility in July 1985. Actions taken by the State, EPA Region II and SCA in the period subsequent to this investigation are summarized in the accompanying update.

Task Force personnel investigated the interim status ground-water monitoring program at the Model City facility for the period between November 1981, when applicable provisions of the RCRA regulations became effective, and July 1985. The investigation indicated that, although the monitoring program had improved considerably since 1981, some parts were inadequate and did not fully comply with State requirements.

The ground-water monitoring program proposed in the August 1983 RCRA Part B permit application submitted by SCA was inadequate. Revisions to the monitoring program proposal were submitted in March, April and May 1985. The revised proposal was much improved over the original submittal, but some changes and clarifications were necessary. Many of these were made during ongoing discussions between EPA Region II, DEC and CWM personnel held before and subsequent to the Task Force inspection. By late fall 1985, only a few issues remained unresolved.

Analytical data from three monitoring wells indicate the presence of organic hazardous waste constituents near two of the closed landfills (SLFs 7 and 10) and an active sludge disposal unit. In two of the wells, the constituent concentrations were very low (i.e., less than 1 microgram per liter); in the third they were much higher (i.e., hundreds of micrograms per liter). The results of chemical analysis of ground-water samples collected from each well within the facility property indicate that, presently, there is no threat to public health or the environment as a result of waste handling practices. The site location is hydrogeologically sound and affords natural protection to the public and environment.

Monitoring data also indicate elevated total organic halogen concentrations in seven wells located near waste management units. However, the

specific halogenated compounds have not been identified because the standard analytical methods used by SCA and the Task Force laboratories were not sensitive to them; special or research methods are required.

Under current EPA policy, if an offsite TSDF must be used for land disposal of waste from a Superfund-cleanup of a CERCLA site, that site must be in compliance with the applicable technical requirements of RCRA. Interim status facilities must have adequate ground-water monitoring data to assess whether the facility poses a threat to ground water. Some parts of the ground-water monitoring program were inadequate and did not fully comply with State requirements.

The following is a more detailed summary of the inspection findings and conclusions.

GROUND-WATER MONITORING PROGRAM DURING INTERIM STATUS

As of July 1985, the SCA Model City facility did not have an adequate interim status ground-water monitoring program. Components of the ground-water monitoring program, including the ground-water sampling and analysis plan, monitoring well network, sample handling procedures and the assessment program outline, need improvement. Sample analyses conducted the initial year of monitoring (March 1984 to February 1985), do not fully comply with applicable State requirements.

A ground-water monitoring program plan, which formed the basis of the July 1985 program, was approved by DEC in July 1982 after considerable public involvement and an adjudicatory hearing. Although the program exceeded the minimum State and Federal regulatory requirements for the number of wells, under current precepts, it does not meet the performance standards. As experience with administering the interim status program and scientific knowledge has increased, so have expectations of ground-water monitoring systems. Many of the deficiencies described below reflect shortcomings of the approved plan rather than present violations of State requirements.

Problems with the monitoring program, implemented during March 1984, at the time of the Task Force evaluation are summarized below and discussed in detail in the body of this report. Problems with the program developed under RCRA (1981-1983) are also discussed in the body of this report.

Ground-Water Sampling and Analysis Plan

The ground-water sampling and analysis plan is inadequate primarily because the shallow (Zone 1) wells are monitored less frequently or for fewer parameters than the deeper (Zone 3) monitoring wells. The Zone 3 wells are monitored in accordance with State regulations [360.8(c)(5)(iii)]. Further, the plan being followed during the Task Force inspection specifies filtering of samples before analysis in contradiction of State policy.

Under the May 1981 General Operating Permit (Special Condition 8), the Company is required to develop a Maintenance, Monitoring and Contingency Plan (MMCP) subject to DEC approval. The monitoring program in the MMCP is to cover "groundwater quality and hydrology for every water bearing zone beneath the facility. . ." and include "sampling schedules, sampling methods, analytical parameters and other pertinent information".

In March 1982, New York promulgated regulations (Part 360 regulations) for hazardous waste management that were nearly identical, although broader in scope, to the RCRA interim status regulations. The following June, an MMCP reflecting these regulations was completed by SCA and subsequently approved by DEC in July. Thus, the MMCP became the State-designated monitoring plan for the facility and incorporated the EPA interim status requirements.

At the time of the Task Force inspection, the June 1982 MMCP had been superceeded by a "plan" comprising unspecified parts of the following five documents:

1. SCA Quality Assurance Plan for Ground-Water Monitoring, dated February 24, 1984

2. Air, Surface Water and Ground-Water Monitoring Plan, SCA Chemical Services, Inc., Model City, New York, dated July 1984
3. WMI Manual for Ground-Water Sampling, undated
4. Laboratory Standard Operating Procedures, as amended February 21, 1985
5. Data Integration Standard Operating Procedures, dated June 10, 1985

As indicated above, the State permit requires that the monitoring plan be approved by DEC. Documents 1, 3, 4 and 5 above were not submitted to DEC for approval. Although document 2 was submitted to DEC, it was never approved by the Department.

The detailed sample collection and handling procedures, followed by SCA personnel beginning in March 1984, were described in the February 1984 SCA Quality Assurance Manual for Groundwater Monitoring. This manual was partially superceded by the WMI Manual for Groundwater Sampling in early 1985. These documents have neither been incorporated into the MMCP for the facility nor have the procedures been approved by DEC. Notwithstanding the lack of approval by DEC, except for filtering of samples, the described procedures were generally acceptable.

Wells designated in the plan for ground-water monitoring are installed in both the first and second saturated flow zones below the ground surface. Both zones (designated as Zones 1 and 3, respectively) are continuous across the site, hydraulically interconnected, and thoroughly documented in the Company's two major reports on site hydrogeology (Wehran 1977 and Golder 1985). Zone 3, is designated by the Company as the uppermost aquifer and monitored in accordance with interim status requirements.

Monitoring of Zone 1 ground water is inadequate because it is done less frequently and for fewer analytical parameters than for Zone 3. Further, no statistical data comparisons have been performed on analytical data from Zone 1 monitoring well samples. Monitoring of this zone, by the frequency and for the parameters specified for the Zone 3 wells, is required to ensure immediate detection of releases from waste management areas.

Analytical procedures for the ground-water samples were not fully defined until the October 1984 Standard Laboratory Methods document was completed. This document was not incorporated into the MMCP and was not completed until 7 months after the initial year of monitoring had begun. This document was superceded by two others (documents 4 and 5 above) during the spring of 1985 when analytical work on ground-water samples was transferred to a contractor laboratory.

Monitoring Well Network

The interim status monitoring well network, which includes 41 wells [Figure 2], is inadequate because the number and location of wells are not sufficient to ensure immediate detection of leakage from all of the regulated units.

In accordance with State regulations [360.8(c)(5)(ii)(a)(2)], SCA has divided the site into five waste management areas, also called Facility Process Areas (FPAs) and has installed monitoring well networks for each. Each network has a minimum of one upgradient and three downgradient wells. Of the 15 designated downgradient Zone 3 wells, 10 are not close enough to the boundary of the waste management area. Further, in FPAs I and II, the locations and number of Zone 1 and 3 wells are not adequate to immediately detect leakage from all or major portions of 16 waste management units subject to the ground-water monitoring requirements.

Sample Handling

Sample collection and handling procedures observed by Task Force personnel were generally adequate. However, some sample aliquots, including those for certain organics and metals analyses, are filtered before analysis. Also, sampling procedures have changed since the initial year of monitoring and sample aliquots for total organic carbon analysis have not been consistently filtered.

Filtering of samples collected for organic analysis contradicts a May 3, 1985 memorandum from DEC regarding "Policy on Altering Water Samples

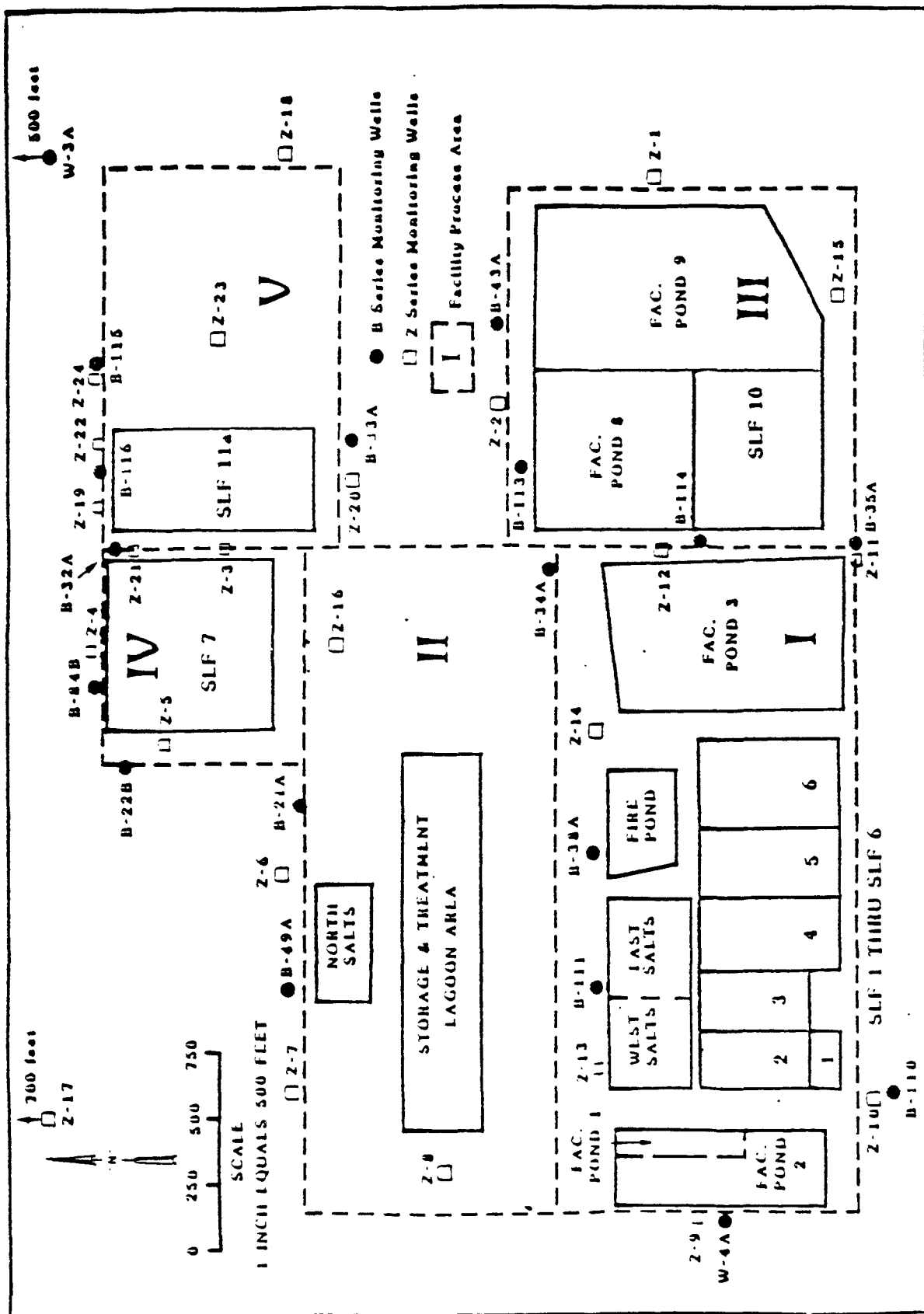


Figure 2
Current Interim Status Monitoring Well Network

to be Analyzed for Organic Compounds". Filtering of samples collected for analysis of metals used to determine the suitability of ground water as a drinking water supply is not consistent with methods required for such supplies [40 CFR Part 141.23(f)]. Data from analysis of filtered samples may be biased low. The effects of filtering on ground-water samples collected at the Model City facility need to be documented.

During the initial year of monitoring (March 1984 to February 1985), sample aliquots for metals and organic carbon were filtered before analysis. Between December 1984 (fourth quarter of initial year of monitoring) and July 1985, procedures in the WMI manual were incorporated. One of these procedures, which is also unacceptable, involves filtering all sample aliquots other than volatile organics and those intended for "total"-type analyses (e.g., total organic carbon, total organic halogen, etc.). Therefore, total organic carbon (TOC) results reported for the initial year of monitoring reflect filtered samples while subsequent results do not. As a result of this practice, statistical comparisons of these data, as required by State regulations [360.8(c)(5)(iv)(b)], are not appropriate.

Analytical Data from the Initial Year of Monitoring

Data obtained for most of the required parameters during the initial year of ground-water monitoring do not meet State regulations [360.8(c)(5)(iii)(c)] because they are not adequate to establish background concentrations or values.

Indicators of Ground-water Contamination

High pH levels (greater than pH 9) have been measured in samples from many of the interim status Zone 3 wells, including all four upgradient wells. SCA attributes the high pH to cement grout used to seal the space between well casing and borehole wall above the well screen. Consequently, the data do not establish background ground-water quality, as required.

Sample data for specific conductance (conductance) are suspect because the values for individual wells varied widely (e.g., 1,187 to 5,526

µmhos/cm in well B-22B) and the variations did not correlate with major ion concentrations.

Data represented as total organic carbon (TOC) analysis results are actually dissolved organic carbon (DOC) results because the samples were filtered before analysis. DOC results cannot be substituted for the required TOC analyses. Further, the DOC data are suspect because the analytical method used produces unreliable data for the low organic carbon levels actually present.

Drinking Water Supply and Ground-water Quality Parameters

Data for parameters characterizing the suitability of the ground water as a drinking water supply are also inadequate. Samples collected for metals analysis were filtered before concentrations were measured, which is inconsistent with requirements for analysis of samples of drinking water supplies, as previously discussed. Inappropriate analytical methods were used for arsenic, chromium and selenium, which resulted in reported concentrations being biased low.

Outline for the Ground-water Quality Assessment Program

The outline for the ground-water quality assessment program presented in the revised MMCP (July 1984) needs improvement. The outline should describe a more comprehensive ground-water monitoring program than that currently in place. The outline needs to be revised to include:

1. Whether or how data triggering assessment would be evaluated to confirm the apparent contamination
2. How the apparent source would be determined
3. Whether or how additional hydrogeologic data would be collected
4. How the rate and extent of contaminant migration would be determined
5. Which aquifer zones would be monitored

6. How a monitoring plan would be developed and what the projected sampling frequency would be
7. Which analyses would be conducted on ground-water and soil samples to identify contaminants of concern
8. Analytical methods to be used on the samples
9. How the data would be evaluated to determine if more work is required or the facility could return to the indicator evaluation program
10. Approximate time frames for sampling, analysis, data evaluation and report preparation

GROUND-WATER MONITORING PROGRAM PROPOSED FOR RCRA PERMIT

The ground-water monitoring program proposed in the August 1983 Part B permit application was inadequate. EPA and DEC informed SCA of the deficiencies during a series of ongoing meetings begun after the Part B was submitted. Revised monitoring program reports and plans were submitted in March, April and May 1985. The revised monitoring plan, although much improved over the original submittal, was also inadequate.

Following the May 1985 submittal, EPA and DEC personnel began a new series of meetings with SCA, which extended beyond the conclusion of the Task Force inspection. The purpose of these meetings was to discuss necessary changes in the proposed program. The problems with the initial number and locations of wells was resolved during the fall of 1985. Unresolved issues being addressed during the fall of 1985 included:

1. The extent to which the ground water beneath the site has been contaminated by site operations
2. Whether certain regulated units (tank 58 and the facultative ponds) are subject to the RCRA ground-water monitoring requirements
3. Whether any filtering of sample aliquots will be allowed
4. The indicator parameters or hazardous waste constituents that will be selected for monitoring
5. The analytical methods that will be used for measuring detection monitoring indicator parameters

6. What statistical procedure will be used to evaluate the impact of the regulated units on the ground water

TASK FORCE SAMPLING AND MONITORING DATA ANALYSIS

During the inspection, Task Force personnel collected samples from 17 ground-water monitoring wells and eight leachate collection sumps to determine if the ground water contains hazardous waste constituents or other indicators of contamination. Samples were drawn by SCA personnel using their standard procedures. Monitoring data from the Task Force samples were analyzed together with previous SCA data from the sampling points.

The data indicate that at least three wells (wells Z-3, Z-11 and Z-13) contain organic hazardous waste constituents. Well Z-3 samples contained 1,1-dichloroethylene, trans-1,2-dichloroethylene and trichloroethylene. SCA and Task Force data show these compounds are present in leachate from the adjacent landfill (SLF 7). Well Z-11 and Z-13 samples contained low concentrations (less than one microgram per liter) of three BHC isomers (alpha, beta and gamma), including the pesticide lindane (gamma isomer); well Z-13 also contained less than 1 microgram per liter of Aroclor 1242 (PCB). The compounds were also detected in leachate samples collected by Task Force personnel at the site. PCBs have been previously detected in leachate by SCA.

Samples from seven Zone 1 (shallow flow zone containing free water table) wells had elevated (greater than 100 µg/l) TOX concentrations. The wells were:

Z-3	Z-11
Z-6	Z-12
Z-8	Z-19
Z-10	

The TOX concentrations in these wells ranged from 100 to 797 µg/l and averaged 271 µg/l. The presence of elevated TOX concentrations is significant because most halogenated organic compounds are suspected of being toxic or carcinogenic and rarely occur in nature. The specific organic halogenated compounds have not been identified by either the EPA contractor or SCA laboratories.

Additional sampling and analysis is necessary to identify the specific halogenated compounds being detected by the TOX analysis and their sources.

TECHNICAL REPORT.

INVESTIGATION METHODS

The Task Force investigation of the SCA Model City facility consisted of:

- Reviewing and evaluating records and documents from EPA Region II, New York State Department of Environmental Conservation (DEC) and SCA
- Conducting an onsite facility inspection July 9 through July 24, 1985
- Evaluating onsite and offsite analytical laboratories
- Sampling and analyzing data from selected ground-water monitoring wells and leachate collection sumps

RECORDS/DOCUMENTS REVIEW

Records and documents from EPA Region II and the DEC offices, compiled by an EPA contractor, were reviewed prior to and during the onsite inspection. Additional DEC records were copied and reviewed by Task Force personnel concurrently with the onsite inspection. Onsite facility records were reviewed to verify information currently in Government files and supplement Government information where necessary. Selected documents requiring in-depth evaluation were copied by the Task Force during the inspection. Records were reviewed to obtain information on facility operations, construction details of waste management units and the ground-water monitoring program.

Specific documents and records that were reviewed included the ground-water sampling and analysis plan(s), outline of the facility ground-water quality assessment program, analytical results from past ground-water sampling, monitoring well construction data and logs, site geologic reports, site operations plans, facility permits, waste management unit design and operation reports, selected personnel position descriptions and qualifications (those related to the required ground-water monitoring program), and operating records showing the general types, quantities and locations of wastes disposed of at the facility.

FACILITY INSPECTION

The facility inspection conducted in July 1985 included identifying waste management units (past and present), waste management operations, pollution control practices, and surface drainage routes, and verifying the location of ground-water monitoring wells and leachate collection sumps.

Company representatives were interviewed to identify records and documents of interest, discuss the contents of the documents, and explain (1) facility operations (past and present), (2) site hydrogeology, (3) the ground-water monitoring system, (4) the ground-water sampling and analysis plan, and (5) laboratory procedures for obtaining data on ground-water quality. Because ground-water samples were analyzed by offsite laboratories, personnel from these facilities were also interviewed regarding sample handling, analysis and document control.

LABORATORY EVALUATION

The onsite and offsite laboratory facilities handling ground-water samples were evaluated regarding their respective responsibilities under the SCA ground-water sampling and analysis plan. Analytical equipment and methods, quality assurance procedures and records were examined for adequacy. Laboratory records were inspected for completeness, accuracy and compliance with State and Federal requirements. The ability of each laboratory to produce quality data for the required analyses was also evaluated.

GROUND-WATER AND LEACHATE SAMPLING AND ANALYSIS

During the inspection, Task Force personnel collected samples for analysis from 17 ground-water monitoring wells and 8 leachate collection sumps [Tables 1 and 2, Figure 3] to determine if the ground water contains hazardous waste constituents or other indicators of contamination. Wells were selected for sampling principally in areas where records show or suggest that ground-water quality may have been affected by hazardous waste management activities. Leachate sumps were selected based on proximity to wells sampled. Other wells were selected to confirm background ground-water quality.

Duplicate volatile organic samples and splits of all other samples were declined by SCA; however, they did collect replicates using their procedures which have been previously described. The wells sampled were equipped with Geomon[®] nitrogen lift pumps except for well B-84A, which had an air-lift sampler. The pumps and air-lift sampler were operated by SCA personnel during collection of Task Force samples. Samples were collected from the wells using the following protocol:

- a. Company personnel determined depth to ground water using a Slope Indicator[®] water level meter.
- b. Company personnel calculated height of water column.
- c. Company personnel calculated three casing volumes.
- d. Company personnel purged the calculated three casing volumes (due to the low recharge rate, SCA procedure is to purge wells the afternoon before sampling).*
- e. After recharge (day after purging), Company personnel collected sample aliquot and made field measurements (water temperature, pH, specific conductance).
- f. Company personnel filled sample containers for required monitoring parameters per the MMCP.
- g. EPA sampling contractor monitored open well head for chemical vapors (HNU[®]) and radiation.
- h. EPA contractor collected sample aliquot and made field measurements (water temperature, pH, specific conductance).
- i. Company personnel filled VOA vials.
- j. EPA contractor filled VOA vials.
- k. Company and EPA contractor alternated filling remaining sample containers in the order shown in Table 3. When NEIC samples were collected, the above protocol was modified to include filling a sample container for NEIC after filling one for the EPA contract laboratory.
- l. Samples were placed on ice in an insulated container.

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* Purge water and excess sample water was not captured by SCA, but was discharged onto ground beside well head.

Table 1
TASK FORCE SAMPLE COLLECTION AND WELL LOCATION DESCRIPTION

Well	Sampling		Remarks	Location/Description
	Date	Time		
B-21A	7/19	1015-1135	Water brownish-red, very turbid	450 ft. southwest of SLF 7
B-22B	7/19	1340-1525	Water brown, turbid	125 ft. west northwest of SLF 7
B-34A	7/24	0815-0930	Containers omitted - 1 ext. organics cyanide, sulfate/chloride, nitrate/ammonia	50 ft. from northwest corner of fac. Pond 8
B-35A	7/18	1020-1130	Water brown, cloudy, turbid	Southeast corner of fac. Pond 3
B-84A	7/19	0840-0905	Water very turbid. Containers omitted - 1 ext. organics, cyanide, sulfate/chloride nitrate/ammonia	Northern edge of SLF 7 berm
B-111	7/24	1010-1100	Containers omitted - 1 ext. organics cyanide, sulfate/chloride, nitrate/ammonia	Northwest corner of East Salts Area
B-113	7/18	1550-1800	Water cloudy, murky brown. NEIC replicate samples collected.	Northern edge of Fac. Pond 8 berm
B-114	7/18	1245-1440	Containers omitted - 1 ext. organics	Western edge of SLF 10 berm
B-116	7/23	1505-1630	Containers omitted - 1 ext. organics, cyanide, sulfate/chloride, nitrate/ammonia	Northern edge of SLF 11 berm
Z-3	7/24	1200-1310	Containers omitted - 1 ext. organics, cyanide, sulfate/chloride, nitrate/ammonia	Eastern edge of SLF 7 berm
Z-4	7/23	1255-1440	NEIC replicate samples collected. Omitted parameters - 1 ext. organics, cyanide, sulfate/chloride, nitrate/ammonia	Northern edge of SLF 7 berm
Z-5	7/23	1100-1230	Triplicate sample collected. 1 purge and trap vial broken	Western edge of SLF 7 berm
Z-9	7/11	0915-1000	Collected VOAs only	Western edge of East-West fac.
	7/12	1430-1545	All other samples collected	Pond
Z-11	7/11	1045-1200	All aliquots collected	Southern edge of Fac. Pond 3
Z-13	7/11	1300-1430	All aliquots collected	Northern edge of West Salts Area
Z-19	7/12	1030-1130	All aliquots collected	Northern edge of SLF 11 berm
Z-21	7/12	1230-1335	Water dark colored - greenish-black	Eastern edge of SLF 7 berm

Table 2
SAMPLE COLLECTION AND SUMP LOCATION DESCRIPTION
LEACHATE WELL DATA*

Sump	Time	Remarks	Location/Description
8	1225-1235	Container omitted - 1 extractable organics	Northwest corner SLF 4
10	1210-1220	All aliquots collected	North central side of SLF 5
15	1145-1200	All aliquots collected	Northern edge of SLF 6
26	1025-1035	Containers omitted - IOX, phenol 1 extractable organics, cyanide sulfate/chloride, nitrate/ammonia	Cell I, SLF 7 (heavy metals)
27	1015-1020	Container omitted - 1 extractable organics	Cell IIa, SLF 7 (pseudometals)
28	1005-1010	Container omitted - 1 extractable organics	Cell V, SLF 7 (flammables)
29	0945-1000	Containers omitted - extractable organics, cyanide, sulfate/chloride, nitrate/ammonia	Cell II, SLF 7 (pseudometals)
32	1045-1100		Cell II, SLF 10 (pseudometals)

* Leachate samples collected on July 22, 1985

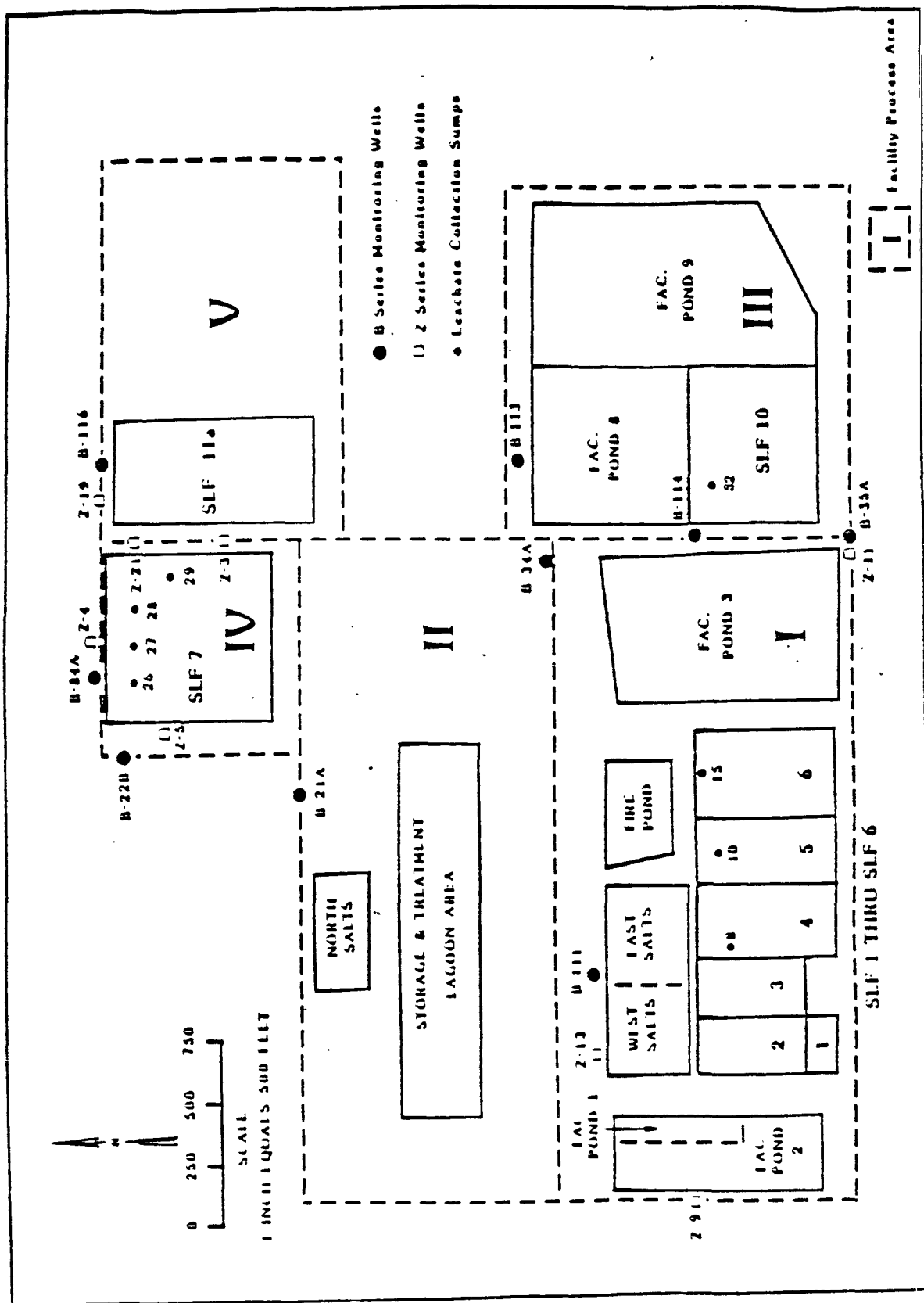


FIGURE 3 Location of Monitoring Wells and Leachate Sumps Sampled

Volatile organic samples collected for analysis by the EPA contract laboratory were first poured into a 250-ml beaker then poured into 60-ml vials (sample containers). At wells equipped with Geomon pumps, all other sample containers were filled directly from the discharge line. At B-84A (the well with the airlift sampler), the sample was initially collected in a clean 2½-gallon jug, then split into the respective aliquot containers.

After sampling was completed at a well, EPA contractor personnel took their samples to a staging area where a turbidity measurement was taken and one of the two sample aliquots for metals analysis was filtered. In addition, metals, TOC, phenols, cyanide, nitrate and ammonia samples were preserved [Table 3].

Leachate was collected at SLFs 4 through 7 and SLF 10. All leachate samples were collected on the same day to prevent possible cross-contamination of well samples through handling and shipping. All personnel involved in the sampling wore full-face respirators and protective clothing. Plastic sheeting was laid around each sampling point in order to prevent area contamination in the event of spillage. After SCA collected their leachate sample, the EPA contractor collected the sample for EPA in a 2½-gallon glass jug. After the leachate sumps were sampled, the 2½-gallon jugs were taken to an onsite area where the individual sample containers were filled. Leachate samples were not preserved.

Some of the jugs of leachate sample contained multiple liquid phases. The EPA contractor could not keep the contents of the jugs mixed while filling the sample containers and the amount of aqueous and non-aqueous phases in the containers varied widely. Consequently, chemical concentrations reported for these samples may not reflect those in the sumps.

At the end of the day, samples were packaged and shipped to the two EPA contract laboratories or NEIC in accordance with applicable Department of Transportation (DOT) regulations (40 CFR Parts 171-177). Aqueous samples from monitoring wells were considered "environmental" and those from leachate collection system sumps were considered "hazardous" for shipping purposes.

Each day of sampling, the EPA contractor prepared field blanks for each analytical parameter group (e.g., volatiles, organics, metals) in a parking lot on the north side of the east salts area by pouring distilled deionized water into sample containers. An equipment blank was prepared by running distilled deionized water through the apparatus used to filter metals. One set of trip blanks for each parameter group was also prepared and submitted during the inspection. The blanks were submitted with no distinguishing labeling or markings.

Samples were analyzed by the EPA contractor laboratories for the parameter groups shown on Table 3 minus the groups indicated on Tables 1 and 2. NEIC received and analyzed replicate samples for two ground-water monitoring wells (Z-4 and B-113).

Table 3
PREFERRED ORDER OF SAMPLE COLLECTION,
BOTTLE TYPE AND PRESERVATIVE LIST

Parameter	Bottle	Preservative
1. Volatile Organic Analysis (VOA)		
Purge and Trap	2 - 60-ml VOA vials	
Direct Inject	2 - 60-ml VOA vials	
2. Purgable Organic Carbon (POC)	1 - 60-ml VOA vial	
3. Purgable Organic Halogens (POX)	1 - 60-ml VOA vial	
4. Extractable Organics	4 - 1-qt. amber glass	
5. Total Metals	1-qt. plastic	HNO ₃
6. Dissolved Metals	1-qt. plastic	HNO ₃
7. Total Organic Carbon (TOC)	4-oz. glass	H ₂ SO ₄
8. Total Organic Halogens (TOX)	1-qt. amber glass	
9. Phenols	1-qt. amber glass	H ₂ SO ₄
10. Cyanide	1-qt. plastic	NaOH
11. Sulfate/Chloride	1-qt. plastic	
12. Nitrate/Ammonia	1-qt. plastic	H ₂ SO ₄
13. Radionuclides (NEIC only)	4 - 1-qt. amber glass	

WASTE MANAGEMENT UNITS AND FACILITY OPERATIONS

WASTE MANAGEMENT UNITS

To identify possible sources and pathways for waste constituents handled at SCA to enter the ground water, waste handling units and operations were identified. The SCA facility handles both hazardous waste, as defined in 40 CFR 261 and regulated under RCRA and DEC regulations, and polychlorinated biphenyl (PCB) waste, as regulated by DEC regulations and 40 CFR Part 761 regulations promulgated under TSCA.

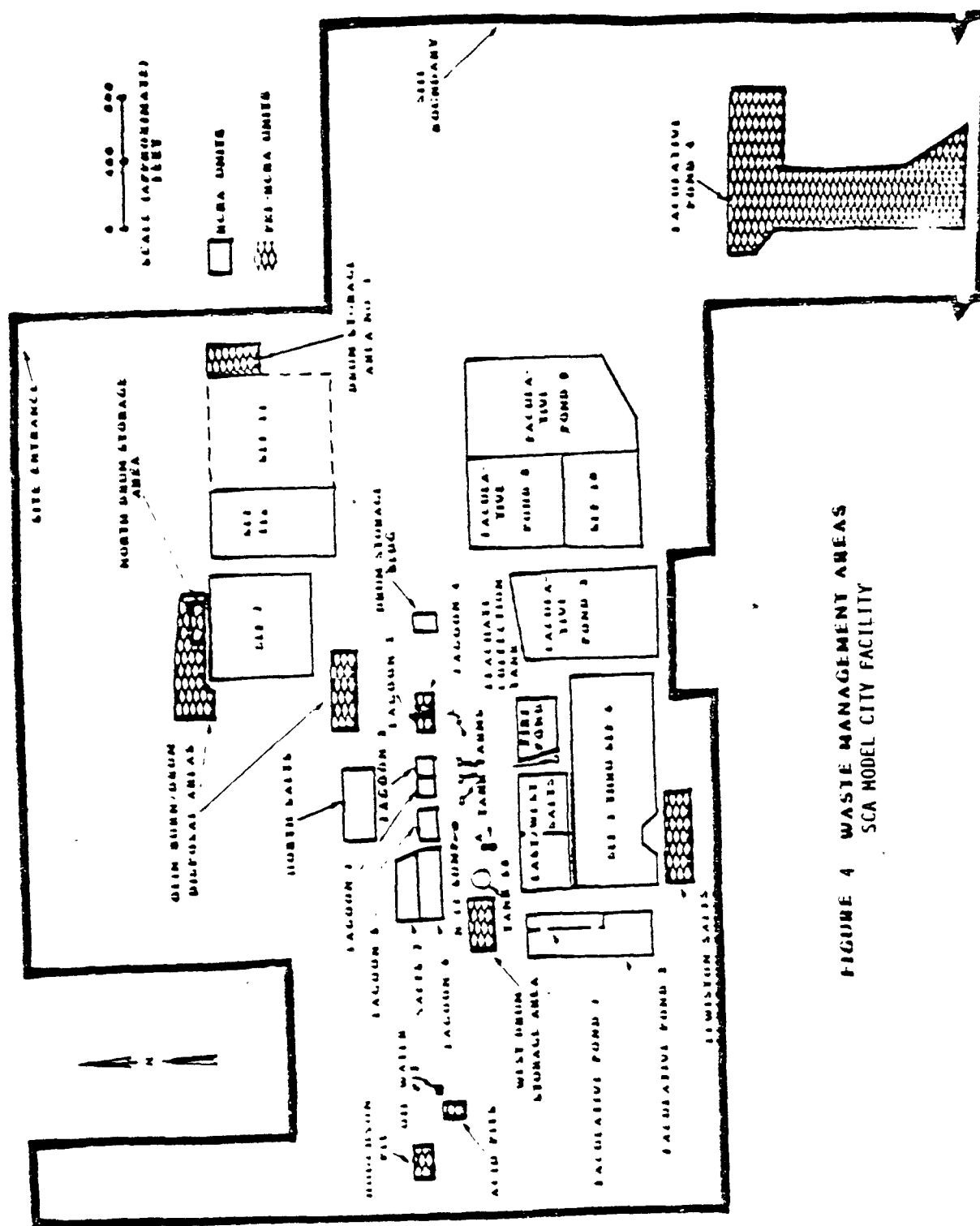
SCA currently uses the following management units/areas for the treatment, storage and/or disposal of hazardous waste:

- Surface impoundments - storage and treatment
- Landfills - disposal
- Tanks - storage and treatment
- Drum storage areas - container storage

Various impoundments, landfills and tank and drum storage areas used in the past are currently inactive. Past operations also included distillation for solvent recovery and thermal destruction (incineration).

PCB waste processing and disposal operations include storage, processing (transformer draining and flushing) for disposal, and landfill disposal. Some stored PCB waste and leachate containing high PCB concentrations are disposed of offsite.

Figure 4 shows the location of SCA treatment, storage and disposal facilities. A discussion of waste management units related to interim status ground-water monitoring at the SCA site follows and is divided into two major areas: (1) units subject to RCRA interim status requirements (active after November 1980) and (2) units or areas operated and/or closed prior to the effective date of RCRA interim status regulations but which may have released contaminants to the ground water.



**FIGURE 4 WASTE MANAGEMENT AREAS
SCA MODEL CITY FACILITY**

Interim Status Regulated Waste Management Units

Surface Impoundments

Surface impoundments, described in Table 4, are used at SCA for hazardous waste treatment, storage and disposal. SCA reported in a March 4, 1985 modification to its RCRA Part A permit application that it has a total surface impoundment storage capacity of about 163 million gallons; surface impoundment treatment capacity is reported as 68,500 gallons per day. Lagoons 1, 2, 5 and 6, Tank 58, the "Salts" storage areas and the facultative ponds are all surface impoundments subject to the ground-water monitoring requirements of RCRA interim status.

Lagoons 1, 2 and 5

Lagoons 1, 2 and 5 are surface impoundments used to receive and store aqueous waste prior to treatment in the aqueous wastewater treatment system. Reduction and oxidation reactions are also conducted in these lagoons on a batch treatment basis. Lagoon 2 has not received waste since 1984 because it was taken out of normal service to store PCB-contaminated sludge removed from Lagoons 1 and 5. In addition to receiving waste generated offsite, Lagoon 5 also receives pretreated (oil/water separation) leachate pumped from the landfills. The general types of waste received in these surface impoundments since 1980, as reported in DEC weekly reports, are given in Table 5.

Lagoons 1 and 2 were constructed by excavating about 6 feet below grade and building berms 10 feet above the original ground surface. Lagoon 5 was constructed by excavating about 4 feet below the original surface and adding berms about 6 feet above the original grade. The sides and bottoms of all three lagoons were originally lined with synthetic liners, reportedly covered with about 2 feet of compacted clay. A comparison between the finished base elevation of these units and the waste liquid and ground-water table surface elevation is shown in Table 6.*

* Detailed discussion of the relationship between depth of the waste management units and the surface of the ground-water table is provided in the May 1985 report, "Groundwater Monitoring Plan, Chemical Waste Management, Inc., Model City, New York", Golder Associates.

Table 4
SURFACE IMPOUNDMENTS

Impoundment Name/Designation	General Use	Status (July 1985)	Approximate Active Operation Dates	Approximate Dimensions (top) l x w x d (ft)	Approximate Capacity (gallons)	Linear Description
Lagoon 1 (west lagoon)	Aqueous waste receipt/ storage and redox reactions	Active ^a	1972 - present	120 x 120 x 10	1.0 x 10 ⁶	40 mil HDPE (replaced Hypalon liner in 1984)
Lagoon 2 (east lagoon)	Aqueous waste receipt/ storage and redox reactions	Active (storage only - contains PCB-contaminated sludge)	1972 - present (stopped receiving waste in 1984)	120 x 120 x 10	1.0 x 10 ⁶	Hypalon
Lagoon 3 (oil/water lagoon)	Aqueous waste receipt/ storage and redox reactions	Inactive ^{aa} (area regraded)	1972 - June 1977	120 x 120 x 10	1.0 x 10 ⁶	Hypalon
Lagoon 4 (oil/water lagoon)	Aqueous waste receipt/ storage and redox reactions	Inactive (area regraded)	1972 - June 1977	120 x 120 x 10	1.0 x 10 ⁶	Hypalon
Lagoon 5	Aqueous waste receipt/ storage and redox reactions	Active	early 1973 - present	240 x 140 x 8	1.8 x 10 ⁶	20 mil chlorinated polyethylene
Lagoon 6	Equalization basin - aqueous waste treatment system	Active	early 1973 - present	450 x 130 x 10	4.0 x 10 ⁶	20 mil chlorinated polyethylene
Tank 58	Aqueous waste treatment	Active	1972 - present	100 ft diameter	0.5 x 10 ⁶ 8 ft deep	Synthetic
Facultative Pond 1 (east pond)	Aqueous waste treatment (biological treatment)	Active	1973 - present	facultative	facultative Ponds 1 and 2 combined	Compacted clay Ponds 1 and 2 combined
Facultative Pond 2 (west pond)	Aqueous waste treatment (biological treatment)	Active	1973 - present	830 x 280 x 20	25.6 x 100 ⁶	Compacted clay
Facultative Pond 3	Aqueous waste treatment (biological treatment)	Active	1973 - present	920 x 575 x 16	50 x 10 ⁶	Compacted clay
Facultative Pond 4	Aqueous waste treatment (biological treatment)	Inactive	1978 - November 1980	Irregular	5.8 x 10 ⁶ 10 acres	Natural clay

^a Unit receiving waste

^{aa} Unit not receiving waste

Table 4 (cont.)

Impoundment Name/Designation	General Use	Status (July 1985)	Approximate Active Operation Dates	Approximate Dimensions (top) L x W x D (ft)	Approximate Capacity (Gallons)	liner Description
Fire Pond	Aqueous waste treatment	Active	1973 - present	380 x 220 x 12	6.8 x 10 ⁴	Compacted clay
Facultative Pond 8	Aqueous waste storage and final biological treatment	Active	June 1978 - present	500 x 500 x 24	43 x 10 ⁴	Native clay
Facultative Pond 9	Aqueous waste storage and final biological treatment	Active	1980 - present	530 x 850 x 17	60 x 10 ⁴	Native clay
West salts area	Aqueous treatment system sludge (salts) storage	Active	1973 - present	420 x 120 x 16	15.6 x 10 ⁴	Roller/compacted clay
East salts area	Aqueous treatment system sludge (salts) dewatering/storage	Active	1973 - present	380 x 250 x 16	10 x 10 ⁴	Roller/compacted clay
North salts area	Aqueous treatment system sludge (salts) dewatering/storage	Inactive	1979 - 1984	520 x 200 x 12	6.0 x 10 ⁴	Roller/compacted clay
Salts area 7 (emergency pond 1, lagoon 7)	Aqueous treatment system sludge (salts) dewatering/storage	Inactive	1979 - 1984	480 x 100 x 15	2.8 x 10 ⁴	Roller/compacted clay
Low of Lewislon salts area	Aqueous treatment system sludge (salts) dewatering/storage	Inactive	1973-1974	Unknown	Unknown	Unknown
Sym. Pits						
Houghton Pit	Organic wastewater	Inactive	1971 - September 1975	200 x 100 x 12	1.8 x 10 ⁴	Concrete
Acid Pit	Acid waste	Inactive	1971 - September 1975	100 x 100 x 12	1.2 x 10 ⁴	Concrete
Oil Pit	Oil waste	Inactive	1971 - September 1975	71 x 30 x 5	80,000	Concrete

Table 5
AQUEOUS WASTE RECEIVED
IN LAGOONS 1, 2 AND 5

Acids
Alkaline paint stripper
Alkaline rinses
Aqueous low TOC
Aqueous polymers
Bases
Combustible liquid
Ethylene glycol/water
Ferric chloride solution
Grinding coolant
Hardeners
MCL waste
Phosphoric acid
Tumbler water
Thiosulfate solutions
Non-chlorinated solvents
Waste hexane
Pretreated landfill leachate

Table 6
BASE ELEVATION AND WASTE LIQUID AND
GROUND-WATER TABLE SURFACE ELEVATIONS
LAGOONS 1, 2 AND 5

Lagoon Number	Estimated Finished Base Elevation (feet amsl)*	Reported Liquid Waste Operating Elevation (feet amsl)	Estimated Surface of Ground-water Table (feet amsl)
1	315	326	313
2	315	326	313
5	316	323	315

* Above mean sea level

SCA records indicate that the liners in Lagoons 1 and 2 were replaced in 1977 and 1982, respectively; the liner in Lagoon 1 was replaced with 40 mil high density polyethylene in 1984. There are no other records of liner replacement for the units.

Lagoons 1 and 2 originally had leachate detection systems installed beneath the liners. These consisted of 4-inch perforated pipes which were packed in coarse sand and drained to individual sumps. SCA facility

personnel stated that the detection system under Lagoon 1 no longer exists. Although the Company indicated belief that this detection system had been monitored in the past, they could provide no information on monitoring results.

Lagoon 6

Lagoon 6 is a surface impoundment normally used for flow equalization of waste feed to the carbon treatment unit of the waste water treatment system. It also receives supernatant from the "salts" areas (discussed later). Construction of Lagoon 6 involved excavating about 2 feet below the ground surface and constructing 10-foot surrounding berms. The sides and bottom were lined with a Hypalon synthetic liner under 2 feet of clay. Final base elevation of Lagoon 6 is about 315 feet amsl. The ground-water table surface elevation in this area reportedly averages 315 feet amsl while the elevation of the liquid waste in the lagoon is maintained at about 324 feet amsl.

State inspection records indicate that liner integrity of this impoundment was compromised in May 1980. The liner was reportedly repaired by SCA shortly after the problems were found.

Tank 58

Tank 58 is a 100-foot-diameter circular surface impoundment receiving effluent from the carbon treatment unit of the wastewater treatment system. Waste in the unit is aerated with subsurface diffusers. SCA claims to get high rates of total organic carbon reduction with this biological treatment unit and reported that a waiver from RCRA ground-water monitoring requirements is in preparation for Tank 58. The impoundment is not seeded with bioactive material and only operates during the warmer months of the year when it discharges to Facultative Pond 2 (west pond), the first in a series of aerated surface impoundments. In cold weather (approximately 4 months per year), the wastewater bypasses Tank 58 and is discharged directly to Facultative Pond 2.

Tank 58 was constructed by excavating 1 or 2 feet of soil, replacing it with a sand base and constructing a 100-foot diameter, 8-foot vertical steel retaining wall. A Hypalon liner was laid down over the sand and secured to the top of the steel walls. Concrete blocks hold the air diffusers near the bottom of the impoundment. The synthetic liner was replaced in 1984.

Salts Areas

The salts areas at SCA (East/West Salts, North Salts and Salts Area 7) are surface impoundments used for dewatering metal hydroxide precipitates generated from pH adjustment during onsite aqueous waste treatment. Decant liquid from these areas is pumped back into the treatment system through Lagoon 6. The dewatered sludge was used as cover in the landfills.* All of the salts areas are bermed excavations with compacted clay liners. There is no liquid collection system at the bottom of any of these units. Only limited construction information is available for these units and there are no as-built diagrams.

The relationship between the finished base elevation of the salts areas units and the average leachate and area ground-water table surface elevations is shown in Table 7. As shown in the table, all base elevations are below the water table. Average leachate levels are above the water table elevations, thereby creating an outward hydraulic gradient across the liner.

Table 7
BASE ELEVATION AND AVERAGE LEACHATE AND GROUND-WATER
TABLE SURFACE ELEVATIONS, SALTS AREAS

Salts Area	Estimated Finished Base Elevation (feet amsl)	Reported Average Leachate Elevation (feet amsl)*	Estimated Surface of Ground-water Table (feet amsl)
East/West	318	328	319
North	311	317	316
7	311	324	318

* When the units were operated

* Sludge in the salts areas was found to be contaminated with PCBs and landfilling of it was halted.

The East/West Salts area is basically a single unit, covering about 10 acres. Limited information indicates that the unit's base is 3 to 6 feet below the original ground surface. The containment berms rise 13 feet above the original surface. DEC weekly reports indicate that the East/West Salts area was used to receive cadmium waste as well as for storage and dewatering of the waste treatment salts.

The North Salts area is a 2-acre impoundment with 3-foot berms constructed above the original ground surface and a base about 9 feet below the original grade. This area was deactivated in 1984 and the salt sludge has since been removed; however, the area is not closed, as defined under RCRA.

Salts Area 7, also referred to as the Emergency Lagoon 7, is about 1 acre in area and was constructed by excavating approximately 8 feet below grade and lining the unit with 2 feet of clay. A 9-foot containment berm was constructed around this excavation. In addition to receiving sludges from the aqueous waste treatment system, DEC reports indicate that the unit was used to receive additional waste and sludge, as shown in Table 8. This area was deactivated in 1984 but has not been closed, as defined under RCRA regulations.

Table 8
WASTE RECEIVED
IN SALTS AREA 7
(Emergency Lagoon 7)

Chromium
Dust with organics
Epoxy organics
Epoxy resins
Industrial sludges
Metal hydroxide sludges

Facultative Ponds

The facultative ponds (1, 2, Fire Pond, 3, 8, and 9) are surface impoundments used for biological treatment and storage of wastewater discharged from the aqueous waste treatment system. The ponds are normally

operated in series with final discharge to the Niagara River through a pipeline from facultative pond 3, 8 or 9. Mechanical aerators are used during warm weather to maintain aerobic conditions in the top layers of these impoundments. During the Task Force investigation, SCA reported that requests for waivers from the ground-water monitoring requirements for these units, as allowed by the 1984 RCRA amendments, were being prepared.

A comparison between the finished base elevation of these units and the reported wastewater and area ground-water table surface elevations is given in Table 9. As shown in the table, all base elevations are below the water table. Operating liquid levels are at or above water table elevations, thereby creating an outward hydraulic gradient across apparently marginal quality liners, as discussed below.

Table 9
BASE ELEVATIONS AND WASTE LIQUID AND GROUND WATER
TABLE ELEVATIONS, FACULTATIVE PONDS

Facultative Pond Designation	Estimated Finished Base Elevation (feet amsl)	Reported Liquid Waste Operating Elevation (feet amsl)	Estimated Surface of Ground-Water Table (feet amsl)
1	304	318	318
2	304	318	318
Fire Pond	317	327	319
3	304	319	318
8	309	330	318
9	312 to 316	328	318

Facultative Ponds 1 and 2 are adjacent units, separated by a low berm which is inundated at times by pond contents. Pond 2 normally receives effluent from Tank 58 in the warmer summer months and discharges to Pond 1. During cold weather, Tank 58 is not used and wastewater is pumped to Pond 2 directly from the carbon treatment column. Wastewater from Pond 1 is pumped to the Fire Pond for additional biological treatment. Facultative Ponds 1 and 2 were constructed by excavating about 15 feet below grade and building an approximately 5-foot berm surrounding the excavations. Both units are reportedly lined with native clay compacted to unspecified permeability.

The Fire Pond is a surface impoundment which receives waste from Facultative Pond 1 and is used for additional biological treatment and wastewater storage. The impoundment base is about 3 feet below the original ground surface with berms rising about 9 feet above the original grade. The unit is reportedly clay lined and discharges to one of the discharge facultative ponds (3, 8 or 9).

The discharge facultative ponds, which normally receive wastewater from the Fire Pond, are used for storage of wastewater prior to discharge. Some biological activity occurs during storage. During ice-free periods, the surfaces of the impoundments are aerated with floating aerators.

Facultative Pond 3, a below-grade impoundment, was constructed by excavating about 16 feet below the original ground surface. The unit has compacted clay bottom and sides. Facultative Pond 8 was constructed by excavating 10 feet below the original grade. A 14-foot dike (built in two phases) was then constructed above the original ground surface. According to engineering reports, the bottom and sides of the excavation consist of natural uncompacted clay except for the berms which were reportedly compacted to a permeability of less than 10^{-7} cm/sec. Facultative Pond 9 was constructed by excavating about 5 feet below grade and building a 12-foot berm above grade. The bottom and sides of the excavation are made up of natural, uncompacted clay except for the berms which were reportedly compacted to a permeability of less than 10^{-7} cm/sec.

Landfills

Landfills, referred to as secure landfills or SLFs by SCA and described in Table 10, are used at SCA for burial of hazardous and PCB waste. SCA reported, in a March 4, 1985 modification to its RCRA Part A application, that it has 1,600 acre-feet of landfill capacity at the facility. Because hazardous waste, as defined by RCRA, was disposed of in all SCA landfills following RCRA enactment, they are subject to the ground-water monitoring requirements of interim status. Only one landfill area is currently active at the facility (11a). The other eight are either closed (SLF 1 through SLF 7) or in the process of being closed (SLF 10). Specific information on each SLF unit follows.

Table 10
LANDFILLS

Landfill Designation	Number Subcells	Current Status	Approximate Active Dates	Approximate Dimensions l x w x d (ft) + (Capacity)	Liner Description
SLF 1	1	Closed	11/71 - 2/73	310 x 125 x 24	Compacted clay over synthetic liner
SLF 2	1	Closed	2/73 - 9/73	310 x 325 x 36	Compacted clay over synthetic liner
SLF 3	1	Closed	10/73 - 9/74	300 x 350 x 32	2 feet compacted clay over 20 mil chlorinated polyethylene liner
SLF 4	2	Closed	9/74 - 9/75	375 x 520 x 30	2 feet compacted clay over 20 mil Hypalon liner
SLF 5	2	Closed	9/75 - 5/77	406 x 590 x 31	2 feet compacted clay over 20 mil chlorinated polyethylene or Hypalon liner
SLF 6	3	Closed	3/77 - 9/78	270 x 505 x 31	2 feet compacted clay over 20 mil Hypalon liner
SLF 7	7	Closed	9/78 - 1/83	550 x 550 x 30	2 feet compacted clay over 30 mil Hypalon liner over 2 feet recompacted glacial till
SLF 10	5	Closed (capping in progress)	8/82 - 12/84	420 x 550 x 34 (186,700 yd ³)	2 feet compacted clay over 30 mil Hypalon liner over 2 feet recompacted glacial till
SLF 11a ¹	4	Active	8/84 - Present	350 x 800 x 14 (180,000 yd ³)	1 foot compacted clay over 60 mil high-density polyethylene membrane over 40 mil Hypalon liner over 2 feet recompacted glacial till

¹ SLF 11a is the first of four sections which will comprise SLF 11 when completed.

Landfills 1 Through 6

SLF 1 through SLF 6 are currently closed and were originally used as waste disposal areas between November 1971 and September 1978. Additional hazardous waste was added in 1982 and 1983 as part of a recapping procedure. These six adjacent landfill units cover a combined area of about 16 acres in the southwest portion of the SCA facility. The individual landfills are separated by common internal berms. Subcells within each landfill, used for waste segregation, are also separated by internal berms.

Available construction information is limited but indicates that the top of the exterior landfill berms average about 16 feet above the original ground surface. The base of these units ranges between 5 feet (SLF 1) and 17 feet (SLF 2) below the original surface. The bottom and sides of the units are reportedly lined with 2 feet of compacted clay over some type of synthetic membrane liner. The soil under the liner is reportedly proof-rolled native clay. A comparison between base elevations of SLF 1 through SLF 6 and the surrounding ground-water table is shown in Table 11. As noted in the table, all bases are below the water table.

Table 11
BASE AND GROUND WATER TABLE
SURFACE ELEVATIONS, SLF 1 THROUGH SLF 6

Landfill Designation	Estimated Finished Base Elevation (feet amsl)	Estimated Surface of Ground-water Table (feet amsl)
1	316	319
2	303	319
3	308	319
4	310	319
5	310	319
6	311	319

SLF 1 through SLF 6 were constructed without any leachate collection or removal systems. Leachate collection drain layers or sloped floors were also not constructed, although some leachate "observation wells" were built.

In 1981, well after the units were originally deactivated, leachate removal standpipes were constructed by drilling through the landfills to within 3 to 5 feet of the original base liners. At least one standpipe was built in each of the landfill subcells. The leachate detection/removal system currently consists of 23 vertical standpipes, 17 of which are actively used to pump leachate out of the units and six of which are used only for monitoring leachate levels. Leachate from the landfill units is pumped to an oil/water separator and then to a 20,000-gallon underground holding tank prior to discharge to Lagoon 5 for treatment in the aqueous waste treatment system. Light and heavy materials from the oil/water separator are shipped offsite for incineration.

Each of the six landfills has a separate cap, except for SLF 1 and SLF 2, which share a single cap. The landfill units were originally capped with 2 feet of compacted clay. In 1982-1983, additional material, consisting of aqueous waste neutralization salts sludge (metal containing hazardous waste generated onsite), municipal wastewater treatment plant sludge and clay, was added to increase the surface slopes of these units. Some of the original clay cap was removed prior to this addition. A polyvinylchloride (PVC) synthetic membrane, overlain with clay and topsoil, was placed on this new material to form the final caps. The slope of the final caps is reported to be about 8%. Surface runoff is collected in swales between the individual landfill caps and directed to the sides of the landfill for surface discharge.

Landfill 7

SLF 7, located in the north central portion of the facility, was used to dispose of waste from about September 1978 to January 1983. General waste types received in SLF 7 from 1980 to January 1983, as reported in DEC weekly reports, are listed in Table 12.

The original unit was constructed in 1978 by excavating about 25 feet below the ground surface. Later, in 1981, the unit was expanded vertically by constructing an exterior containment berm about 8½ feet above the original

grade. Seven individual subcells, separated by internal berms, were constructed within SLF 7 for waste segregation. The bottom and sides of SLF 7 are underlain with 2 feet of rolled clay (maximum permeability of 10^{-7} cm/sec) overlain with a 30-mil Hypalon liner above which is another 2 feet of compacted clay (maximum permeability of 10^{-7} cm/sec). The finished base elevation of SLF 7 is about 296 feet amsl. The surface of the groundwater table in the area near SLF 7 is at about 310 feet amsl, 14 feet above the finished base of the landfill.

Table 12
WASTE RECEIVED IN SLF 7

Acid sludges	Organic tars
Acid solutions	OPC still bottoms
Arsenic waste	Paint waste
Baghouse dust	PCB wastes
Barium compounds (I)*	Phenolic still bottoms
Benzoic acid	Phenolic resins
Carbon tetrachloride	Phthalic anhydride
Calcium fluoride cake	PLC
Caustic solids (I)	Plating sludge
Chlorinated solvents	Polymer tars
p-Chlorobenzotrifluoride	Pyridine tars
still bottoms	Ronnex reactor sludge (III)
Coal tar sludge (I)	Selenium (III)
Corrosive liquid	Sodium chlorate
Cyanide solids	Sodium oxalate
Epoxy 314	Soil with organics
Filter cake with organics	Spent carbon (IV)
Flu dust (I)	Titanium dioxide
Formaldehyde (I)	TMAC still bottoms
Halogenated organics	TPC still bottoms
Incinerator ash	Trichlorobenzene sulfonate
Industrial sludge (IV)	Vanadium and SK sludge
Lab chemicals	Waste oil
Mercury sludges	Waste solvents
Metal hydroxide sludge (I)	WWTP sludge (IV)
Methylene dianiline	Waste solvents
Naphthalene	Xylene
Organic polymers	Zinc hydroxide sludge

* Numerals in parentheses identify disposal subcell.

SLF 7 was not constructed with a leachate collection drainage layer; however, the bottom is reportedly sloped (minimum slope of 1%) toward individual leachate collection standpipes placed in the subcells. Four of the

seven subcells* (1, 2, 2A, 3 and 4) have individual riser pipes connected to a common manifold for leachate removal. Subcells 5 and 5A share a common riser and subcell 4, the halogenated "toxic" subcell, has its own riser. Leachate is reportedly pumped from all subcells, except for subcell 4, by float-activated, submersible pumps, to an underground oil/water separator, adjacent to SLF 7, for pretreatment prior to final treatment in SCA's onsite aqueous waste treatment system. Leachate is pumped to the treatment system through underground pipes. Subcell 4 has a manually activated pump with its own leachate withdrawal pipe. The operation permit for Landfill 7 requires that leachate levels in all subcells be maintained at less than 2 feet above the landfill floor.

The final cap of SLF 7 consists of, in descending order, 6 inches topsoil, 18 inches uncompacted "clayey" soil, polyvinylchloride (PVC) membrane, and 3 feet compacted clay (maximum permeability 10^{-7} cm/sec). The cover is sloped about 8% for surface runoff.

Landfill 10

SLF 10, located in the southeastern portion of the active SCA site, was used to dispose of RCRA hazardous waste and PCB material between August 1982 and December 1984. It is currently being capped for closure. General waste types received in SLF 10, as reported in DEC weekly reports, are listed in Table 13.

SLF 10 was constructed by excavating to an average depth of about 27 feet below grade. An exterior berm was built about 14 feet above the original ground surface. The base and sides of the unit were lined with 2 feet of recompacted clay (maximum permeability of 10^{-7} cm/sec) overlain by a 30-mil Hypalon liner and 2 additional feet of compacted clay. Internal berms were constructed of compacted clay to provide five subcells for

* SLF 7 originally had five subcells, one each for heavy metals, pseudo-metals, flammable waste, halogenated (toxics) waste, and general waste. Subcells 2 and 5 were later split to better accommodate waste volumes received.

segregation of heavy metal, flammable, pseudometal, halogenated and general waste. Subcell 4, the halogenated waste subcell that received PCB wastes, has an additional high-density polyethylene (HDPE) liner directly above the Hypalon membrane. The finished base elevation of SLF 10 is at an average elevation of about 300 feet amsl. The surface of the ground-water table of the area is at an elevation of about 318 feet amsl.

Table 13
WASTE RECEIVED IN SLF 10

Antimony oxide (II)*	Lead compounds
Alkaline paint stripper	Lead-chrome pigment
Ammonium hydroxide	Metal hydroxide sludge
Ammonium persulfate	Maleic anhydride
Calcium arsenate	Mercury waste
Arsenic waste	Methylene chloride bottoms
Aromatic hydrocarbon still residue	Methylene dianiline
Asbestos (II)	Naphthalene
Baghouse dust	Organic solids (III)
Barium chloride salt	Paint sludge (III)
Barium ferrite sludge	Pesticides
Benzoic acid	Phenolic still bottoms
N-butyl acetate	PCB solids/soil (IV)
Cadmium	Phenolic resin
Calcium arsenate	Phthalic anhydride (IV)
Calcium phosphate	Pickle liquor
Caustic solids (I)	PLC (V, III)
Cellulose acetate	Plating sludge (I)
Chlorotoluene sludge	Polyester resin
Chlorinated solvents	Polyglycol filter cake
Chlorinated still bottoms	Polyvinyl acetate emulsions
p-Chlorobenzotrifluoride	Polyurethane (VI)
Chrome plating sludge	Polymeric tar
Creosote coal tar	Potassium ferrocyanide
Dioctyl phthalate	Pyridine tars
Dowtherm	Ronnex sludge (III)
Diethanolamine	Selenium (III)
Dye compounds	Sodium chlorate
Epoxy 314	Sodium oxalate
Formaldehyde	Spent carbon (IV)
4-Fluoro-3-nitroaniline tars	Titanium dioxide
Glycols	Trichlorobenzene sulfonate
Halogenated organics	Vanadium and SK sludge
Heavy metal sludges	Waste solvents
Herbicides	WWTP sludge
Industrial sludge (I)	Xylene
Iron sulfate	Zinc hydroxide sludge
Lab chemicals	

* Numerals in parentheses identify disposal subcell.

Each subcell has an individual leachate collection and removal system consisting of lateral, gravel-packed, french drains sloping about 2% in the same direction as the slope of the floor to the leachate collection line and a sloped riser pipe. Leachate is pumped to an underground oil/water separator located adjacent to SLF 10 for pretreatment prior to final treatment at the onsite aqueous waste treatment system. Leachate is pumped to the treatment system through underground pipes. The State-issued operation permit for landfill 10 requires that leachate levels in all subcells be maintained at less than 2 feet above the landfill floor.

At the time of the Task Force evaluation in July, the landfill had been covered by 3 feet of compacted clay and was in the 1-year "subsidence" stage of the capping operation. The subsidence stage is provided to observe and correct any subsidence in the landfill before installing the PVC synthetic membrane and final cover material.

Landfill 11

SLF 11, located on the east side of SLF 7, is the only currently active landfill. It is operated as a continuous landfill, which means that one section is operated for disposal while the adjacent section is being constructed. When all four sections are completed, the total area of SLF 11 will be about 25 acres. General waste types received in SLF 11a, as recorded in DEC weekly reports, are listed in Table 14.

Table 14
WASTE RECEIVED
IN SLF 11a

Asbestos
Baghouse dust
Laboratory chemicals
Paint sludge
Plating sludge
Paint stripping salts
Phenolic still bottoms
Phosphoric acid sludge
PLC
Sodium dichromate
Still bottoms
Waste oil sludge

During the Task Force inspection, the initial section, SLF 11a, was receiving waste for disposal while the adjacent section, SLF 11b, was under construction. SCA proposes to build all four sections in the same basic manner as the initial section; however, a leachate collection system will be added between two synthetic liner membranes in the three remaining sections.

SLF 11a was constructed by excavating about 14 feet below the original surface. External berms, about 10 feet above the original grade, were then built. The bottom and interior sides are lined with 2 feet of recompacted clay (maximum permeability of 10^{-7} cm/sec) overlain with a 40 mil Hypalon membrane. An 80 mil HDPE liner was placed on top of the Hypalon and was covered with 1 foot of compacted clay (maximum permeability 10^{-7} cm/sec). Four subcells were constructed using internal berms to segregate heavy metals, general organics, toxic waste and flammable waste (a pseudometal subcell was not constructed in SLF 11a but will probably be included in the future adjacent units). The base elevation of SLF 11a is about 305 feet amsl, while the surface of the ground-water table in the area is estimated to be about 313 feet amsl.

To enhance leachate collection, a drainage blanket, consisting of a geotextile covered with 1 foot of stone, was placed over the top layer of the compacted clay. The bottom of each subcell was sloped about 1% toward collection sumps. The first lift of waste disposed of in SLF 11a reportedly consisted of only drummed waste backfilled with stone to further enhance leachate collection and removal. Each of the four subcells is constructed with individual leachate collection and removal systems. Leachate is automatically pumped to an oil/water separator and then to the onsite aqueous waste treatment plant. The State-issued operation permit for landfill 11 requires that leachate levels in all subcells be maintained at less than 2 feet above the landfill floor.

Non-Interim Status Regulated Waste Management Units

In addition to the waste management units regulated by RCRA, as described previously, other units, which were reportedly inactive prior to

November 1980 (effective date of RCRA regulations), are potential sources of ground-water contamination. These units must be considered when evaluating the facility's ground-water monitoring program and resulting data because waste constituents from these activities may be detected by the monitoring system.

On May 20, 1985, SCA submitted to EPA Region II known information pertaining to past releases of hazardous waste constituents at the Model City facility. This, along with additional information regarding some of these units/activities, is discussed below. Some areas, such as the Olin burn area, are currently under study for potential environmental releases; future studies are planned at other areas. These areas are shown in Figure 3.

Olin Burn Area/Drum Disposal Areas

The Olin burn area, located north and northwest of SLF 7, was used by Olin in the 1950s for disposal of rocket fuels and related waste material. Associated with the Burn Area is a plot of ground directly north of SLF 7 where drums of waste, including lithium and boron salts, were buried. Another area, southwest of SLF 7, also may have been used for disposal of drummed waste. The exact boundaries of these areas are unknown.

In late 1981, SCA and Olin jointly excavated and disposed of about 2,000 cubic yards of contaminated material from the area northwest of SLF 7 and about 30 drums of waste from the area directly north of SLF 7 in late 1981. In June 1983, while SCA was excavating a trench for monitoring well Z-4, north of SLF 7 and near the burn area, water having "foul odors" was encountered about 10 feet below the ground surface. The trench was backfilled.

In early 1984, SCA met with representatives of the U.S. Army Corps of Engineers to discuss complete cleanup of these areas. The Corps of Engineers contracted with a consultant to study the area. The consultant's August 1985 report on areas studied indicates that drums may still be buried at the sites directly north of SLF 7 and southwest of the landfill. The report

also stated that PCBs were present in soil samples from the area northwest of SLF 7, and PCBs and pesticides were found in the soil of the area directly north of the landfill (concentrations were not given). Areas sampled also contained relatively high concentrations of boron, lithium and potassium.

North Drum Storage Area

The currently inactive North Drum Storage Area, located just north of the closed SLF 7, was used by SCA for storage and staging of drums prior to their disposal in SLF 7. The area was not lined and soils from this area were not excavated following deactivation of the unit. The western portion of the North Drum Storage Area probably overlapped the Olin burn area.

West Drum Storage Area (Storage Area 2)

The West Drum Storage Area, located west of Tank 58, is an approximately 1.4-acre area used until about 1982 for drum storage. There are reports of spills and leaks from the stored containers in this unit. State inspection reports indicate that badly deteriorating and leaking drums were found on numerous occasions in this area and ponding precipitation threatened to spread hazardous waste from the area. A berm was eventually constructed in an attempt to limit the area of release.

During 1983 and 1984, contaminated soil from the area was excavated. Soil core analyses conducted in mid-1984 indicate that waste constituents, including methylene chloride and trichloroethylene, remained in the soil.

Currently, surface runoff is accumulated within the excavated area and "pre-qualified", through sampling and analysis, prior to discharge to the area's surface drainage system.

Underground Leachate Collection and Storage Tank (20,000 gallons)

SCA uses a 20,000-gallon buried tank, located west of the Fire Pond, to collect and store leachate pumped from the oil/water separators, prior to treatment at the onsite aqueous waste treatment facility. A leachate

detection system, consisting of gravel-packed perforated pipe, was constructed below the tank when the unit was installed. Although liquid has been collected in the sump for this system, SCA reports that the material has not been analyzed for hazardous constituents. SCA pumps the liquid from the leachate system into the tank for eventual treatment. Liquid from the tank is pumped to Lagoon 5 through buried pipes.

N-11 Sump

The N-11 sump, an unlined excavation located south of Lagoon 6, was used between 1972 and 1983 to hold waste and washout liquid from the lime mixing tank of the aqueous waste treatment system. Lime is used in the system for pH adjustment. The waste placed in the N-11 sump consisted of metal hydroxide salts with organics. In the fall of 1984, the sump was removed by pumping about 6,000 gallons of salt slurry to the salts storage areas and excavating about 925 cubic yards of soil. A soil core sample was taken after excavation and analyzed for "leachability" and EP toxicity (metals). Sample results are included in the May 20, 1985 letter from SCA to EPA Region II regarding prior releases from hazardous waste management areas. The excavation was backfilled with "clean" soil.

Tank Farms

SCA operates a series of tank farms for storage of RCRA and PCB waste. All tanks have containment berms constructed either of soil or concrete. Leakage from the tanks, waste transfer operations and drums (reportedly stored inside the bermed area of at least Tank Farm E) has occurred on numerous occasions, as reported in the May 20, 1985 letter to EPA, Region II on past releases. Furthermore, a tank in Tank Farm E, used to store Pentac and "C-56", waste reportedly developed a leak. Cleanup began in April 1985 and included excavation to a depth of 20 feet around the tank site. During this excavation, a drain tile and sand lenses were found which could have caused the leaked material to migrate away from the area. The tanks in Tank Farm E were removed in the early 1980's and the area within the berms was excavated and soil core samples reportedly taken.

However, SCA personnel stated that the analysis results of the core samples were not available.

Tank Farm A, located south of Lagoon 6 and east of Tank 58, was in the process of being removed during the Task Force site inspection in July 1985. An excavation in the area where one of the tanks had been removed showed the presence of black, tar-like soil and strong odors. Excavated soil was sampled and analyzed by SCA and was being disposed of onsite in SLF 11a.

Lagoons 3 and 4

Lagoons 3 and 4, which were located directly east of Lagoon 2, were used as waste receiving surface impoundments, similar to the currently active Lagoons 1 and 2, from 1972 to 1977. They were reportedly constructed by excavating 2 to 6 feet below grade and building berms 7 to 10 feet above grade. They were lined with synthetic liners. Following deactivation in June 1977, all waste material was reportedly removed from these units and the area regraded. No information was available to determine if soil beneath these impoundments contained any hazardous waste constituents.

Underground Acid/TNT Lines

Numerous underground pipes, abandoned from previous site operations, exist below the SCA site. These lines have been implicated in reported spill incidences such as the January 1978 "green acid spill". In early 1978, the DEC required Chem-Trol to sever and cap or plug all known abandoned underground lines to prevent materials from leaving the site. SCA subsequently excavated some of the lines and plugged or capped others that were found. Despite the work on known underground lines; SCA does not know whether all have been discovered and cut off.

Liquid Waste Mixing Pit (Stabilization Pit)

The liquid waste mixing pit, referred to as the stabilization pit by SCA, was located south of SLF 7 and north of the drum storage building. It

was used to mix liquid waste and sludge with stabilizing material, such as soil, prior to landfilling. Waste was brought to the pit in either a steel "roll-off" or dump truck, which was driven into this shallow bermed excavation and mixed with stabilizing materials using a backhoe. The pit is no longer active.

"Syms Pits"

The three "Syms pits", located at the western end of the property and including the Houghson pit, acid pit and oil pit, are concrete-lined surface impoundments. These pits were used from 1971 to late 1975 for storage and/or treatment of liquid waste. The acid and oil impoundments were reportedly used for acid and oily liquid waste, respectively. The Houghson pit was used for wastewater containing organics. These impoundments are located west of the currently active area of the facility. SCA does not consider these to be RCRA-regulated units because they are no longer used for handling hazardous waste.

The bottoms of these impoundments are 4 to 10 feet below the ground surface. The concrete 'liners' extend about 2 feet above the ground surface. Little other information is available on construction and operation of these units.

SCA reported that each impoundment was washed with a high pressure water stream when the impoundments were taken out of service in 1975. All three impoundments contained accumulated precipitation when observed during the Task Force inspection. At that time, the Houghson and acid impoundments had an oily sheen on the surface of the accumulated water.

Town of Lewiston Salts Area

This salts area, located south of SLFs 1 through part of 4, was used to store sludge from the onsite aqueous waste treatment facility until about 1974, when the waste was removed. Little information is available pertaining to the size and capacity of this unit. Also, it is unknown whether this unit was clay lined. Currently, this area is swampy and overgrown with vegetation.

Facultative Pond 4

Facultative Pond 4 is no longer in service. It was used between 1978 and 1980 as a treated wastewater storage surface impoundment. This impoundment was essentially a bermed surface depression. Before use as a facultative pond, part of the area was apparently bermed (3.5 feet high) to prevent flooding of buildings (now abandoned) in the area. Additional berms (6 feet high) were added to totally enclose the original bermed area and the resulting "boot-shaped" area was used for wastewater storage. Soil from the area was reportedly excavated when this area was taken out of service. Post excavation soil sampling was conducted. Analytical results for these samples were submitted by SCA to EPA Region II in a May 20, 1985 letter regarding prior releases from hazardous waste units.

Drum Storage Area No. 1

Drum storage area No. 1 was used for container storage prior to 1980. It was apparently a 300' x 150' unlined area. Records report incidences of leaking drums and small spills of unknown waste material. Some spill locations were reportedly "scraped". It is currently bermed and used to store truck trailers. Rainwater from the area is collected and reportedly treated at the onsite aqueous wastewater treatment system. The area will eventually be excavated for use as part of SLF 11d.

FACILITY OPERATIONS

Improper facility operation can result in the release of hazardous waste constituents to ground water. Task Force personnel reviewed records of DEC weekly inspections and landfill leachate for indications of operational problems that might lead to waste releases and information to aid in interpreting ground-water monitoring data.

To either conduct an interim status assessment monitoring program or complete a RCRA Part B permit application, TSDF personnel need to know the identity and location of waste constituents in the regulated units. This

information must be maintained in the operational record for the facility. Consequently, operational records, including selected waste preacceptance and tracking records, were reviewed to evaluate how well waste constituents have been identified in incoming waste and whether the disposal locations have been properly recorded and reported to DEC.

DEC Onsite Monitoring Reports

The DEC maintains personnel onsite to monitor SCA's daily waste management activities. The State personnel prepare weekly reports outlining their observations and findings. Data generated by their daily inspections include status of covers on closed landfills, erosion of these units and surface impoundments, types of waste being placed in the active cells, leachate pumping volumes, leachate levels and other miscellaneous information. The reports began in January 1980, nearly 11 months before the RCRA regulations covering facility operation became effective. A review of these reports revealed some problems with the integrity of the liners in some of the waste handling lagoons and possible movement of leachate through electrical conduits of the leachate collection systems in SLF 1 through SLF 6.

The DEC reports indicate that several of the impoundment liners have been torn or floated to the surface. Lagoon 1 experienced a series of tears during the first 2 weeks of June 1980. The liner also floated to the surface during the week of May 8, 1980 probably due to gas accumulation under the liner. Tears were also found in Lagoon 6 during the week of May 15, 1980 and on November 9, 1984. All problems were reportedly corrected after being discovered.

State inspection records for much of 1983 report instances when fluid was flowing through the electrical conduits of the leachate collection system of SLF 1 through SLF 6 and accumulating in manholes. Based on odor and appearance of the liquid, the inspectors felt the fluid resembled leachate. SCA personnel stated that the fluid migration stopped after the conduits were relocated above the waste in the landfill.

Landfill Leachate Monitoring

The DEC operating permits for SLF 7, SLF 10 and SLF 11a and the general operating permit (for SLFs 1 through 6) require that leachate levels, when measured from the lowest level of the landfill cells, do not exceed 2 feet. This requirement is intended to keep leachate levels below the adjacent water table so as to maintain an inward hydraulic gradient, thus preventing outward migration of leachate.

A review of leachate levels in the various landfill sumps for the period 1982-1983, from State inspection reports [Table 15], show that the 2-foot maximum permitted level is frequently exceeded. Records show that leachate levels in standpipes in SLFs 1 through 7 have consistently exceeded the 2-foot level. Leachate levels in SLF 10 are generally meeting the 2-foot level, but there have been exceedences.

The landfill leachate levels given in Table 15, together with estimates of the elevations of each landfill base and the surface of the surrounding ground-water table [Table 8] indicate that leachate generated within some units often exceeded the level of the surrounding ground water. For example, the base elevation of SLF 1 is estimated to be about 316 feet amsl, while the surface of the surrounding ground-water table is at about 318 feet amsl. Leachate accumulations of greater than about 2 feet would create an outward hydraulic gradient (i.e., toward the surrounding ground water). Leachate levels consistently exceeded the 2 foot level for SLF 1 during all of 1982 and 1983 [Table 15]. Similar comparisons show that leachate generated in SLF 1 through SLF 6, for at least 1982 and 1983, frequently created outward hydraulic gradients. Records also indicate that leachate has, at times, generated an outward hydraulic gradient in SLF 7.

Waste Characterization and Tracking

Waste characterization before receipt at a TSDF and tracking after receipt are required under both RCRA and State interim status regulations. These are important in determining the constituents that could potentially

Table 15
RECORDED LEACHATE LEVELS FOR SCA LANDFILLS¹
(feet).

Landfill (SLF) No.	Swamp No.	01/13	02/09	04/14	05/18	06/17	07/21	08/20	09/14	10/25	11/17	12/01
1982												
1	1	9	10.1	9.5	5.5	5.3	15.5	5.7	5.8	6.9	6.6	14.9
1	2	12	12.5	13.1	9.9	8.9	-2	5.9	6.9	7.2	7.4	-
2	3	18.5	18.2	17.8	17.9	18.8	18	10.6	14.3	17.5	18	13.7
2	4	30.9	10.1	3.8	4.3	23.1	3.6	3.5	13.3	15.2	22.2	22
3	5	10.5	10.2	8.2	7.4	9.2	7.3	7.1	6.9	7.4	10.5	10.4
3	6	23.9	28.8	11.3	19.8	21.8	21	19.3	18.8	20.5	23.6	23.2
4	7	-	-	-	-	-	-	-	-	-	-	-
4	8	-	22.1	-	9.6	14.5	25.5	17.8	8.4	12.7	18.9	3.1
4	9	25.8	21.1	-	3	2.6	2.9	5.4	2.3	9.3	17.3	4.3
5	10	8.2	-	-	9.1	-	-	6	-	8.4	10.8	8.3
5	11	-	-	-	-	-	-	-	-	-	-	-
5	12	-	23.9	-	23.6	20.5	18.8	1	2	5	14.4	6.7
5	13	-	-	-	16.4	16.4	11.6	8.1	6.6	8.9	9.8	7.7
5	14	-	16.5	-	19.8	24.1	20.5	8.9	14.8	17	10.6	15.9
6	15	3.2	-	-	-	0.3	-	-	-	-	-	2.2
6	16	6	5.5	-	4	9.3	3.8	5.8	5.7	17.6	19.3	18.8
6	17	15	6.7	-	-	-	-	-	-	4.9	3.5	11.9
6	18	7.5	8.2	-	3.8	-	3.7	4.3	3.3	7.8	7.7	8.7
6	19	14.9	13.6	-	-	1.2	8.1	3.3	5.1	20	10.5	13.2
6	20	14.4	13.8	-	19.1	0.9	2.8	5.5	1.6	6.9	18.9	16.8
6	21	12	11.9	-	12.7	13.6	13.2	13.5	13.5	7.7	13.7	12.7
6	22	23.7	22.3	-	10	10.9	10.5	8.5	12.2	13.9	17.4	18.6
6	23	19	19	-	24	-	3.2	2.3	1.2	11.6	17.6	19.8
6	24	9.1	3.5	-	4.8	-	4.1	4.9	5	4.5	8.7	10.9
6	25	18.2	16.3	-	-	9.7	0.7	7.2	4.7	7.5	10.9	13
713	26	20	21.5	-	2	20.5	6.4	4.3	9	15	12	8.6
711	27	20.5	22	-	3.7	2.5	2.7	3.3	3.5	1.4	9	7
711	28	-	17.2	12.8	4.3	-	3.6	10.3	13.8	3.8	8.6	2.5
711	29	22.8	21.3	7.1	11.9	3.7	7.9	8	8.1	1.6	9.8	8.7
711	30	26.4	-	13.7	-	-	4.5	4.5	3.9	2.9	9.6	3.2
711	31	27.1	15.5	6.4	5.9	21.6	-	5	-	2.9	7.7	6.3

Table 15 (cont.)

Landfill (SLF) No.	Sump No.	01/17	02/18	03/25	04/29	05/27	06/24	07/22	08/21	09/27	10/28	11/18	12/30
1983													
1	1	6.6	6.4	6.5	8.5	8.3	4.2	8.1	6.6	8.9	8.6	9.8	12
1	2	7.3	7.8	5.5	8.5	7.5	5.8	7.2	6.7	6.7	6.1	7.1	10.3
2	3	16.6	16.8	16.7	18.7	16.6	15.9	15.7	11.2	16.1	17.5	9.1	18.7
2	4	10.3	13.5	11.3	14	12.7	16.1	6.7	16.1	14.3	1.3	31.1	15.1
3	5	14.9	7.3	6.2	8.7	8.1	7.4	6.7	8.9	4.8	6.8	6.9	7.5
3	6	27.1	4.3	7.8	6.8	5.7	3	2.6	6.2	7.2	17	4.2	5.5
4	7	-	-	-	-	-	-	-	-	-	-	-	-
4	8	12.4	2.3	1.4	3.1	2.3	2.1	14	2.6	0.9	0.6	-	0.6
4	9	5.1	4.1	3.1	2.7	2	2.4	2.4	5.7	1.6	2.8	1.7	7
5	10	6.1	3.4	1.1	4.3	2.2	<2	2.5	4.1	6	1.8	5.3	8.2
5	11	-	-	-	-	-	-	-	-	-	-	-	-
5	12	2.5	5.5	8	4	2.8	3.6	3.5	5	13.2	1.4	2.4	8.9
5	13	5.7	7.7	0.4	8.4	1.6	<2	7	8.4	6.3	8.1	3.4	9.1
5	14	13.5	5.5	4	5.2	5.1	0.6	<1	5.5	9.2	1.1	3.2	-
6	15	-	-	1.8	1	1.7	<2	2	1.7	6.8	8.8	8.5	2.4
6	16	16.8	4.6	3	5.3	4.3	4.7	1.1	4.4	4.5	1.9	4.4	12.6
6	17	5.9	2	2.7	0.7	2.1	7.2	2.3	1.7	0.4	1.7	1.5	7.7
6	18	2.9	2.8	1.8	4.4	3.2	2.7	2.9	3.7	3.1	4.1	8.2	-
6	19	8.9	0.9	0.5	2.8	2	5.2	1.6	3.1	2.4	0.9	3.5	-
6	20	19.4	-	14.6	0.6	1	14.6	2.3	3.2	7.4	3.4	0.1	25.1
6	21	21.5	21.6	16.3	19.4	16.2	15.4	13.5	11.9	15.2	0.4	14.7	4.2
6	22	11	10.4	9.5	10.9	10.5	10.4	3.1	16	17.7	0.5	16.3	0.5
6	23	3.1	3	3.4	3.4	1.3	2	1.4	1.7	3	6.4	-	12.3
6	24	5.5	6.1	4.5	6.8	5.9	4.3	4.5	6.4	4.9	2.3	27.2	-
6	25	2.3	5.8	2	3.2	9.6	3.7	3.1	12.8	13.3	0.8	1.5	2.7
6	26	11.8	4.7	6.5	5.5	0.9	1.6	1.5	1.4	6.5	3.6	1.9	13.5
7 I	27	3.7	3.2	0.7	5.4	3.7	1.2	1.9	3.7	4	4.1	3.1	1.3
7 V	28	2.9	1.3	1.8	10.9	3.2	1.8	1.5	3.1	3	3.7	2.2	8.9
7 II	29	6.5	7.3	3.6	10.4	1.1	1.7	1.1	0.6	10.5	3.8	6.6	4.9
7 IV	30	3.9	2.7	2.3	5.7	1.7	1.1	1.3	1.1	3.7	0.9	2.9	9.8
7 III	31	1.7	5.6	2.9	-	1.4	1.7	1.3	1.2	3.9	1.7	0.9	14.3
1984													
10 I				3.5	2.4	1.5	4.4	1.2	1	2	1.9	0.9	5.5
10 II				4.6	2.3	1.3	0.8	<1	1.1	1.6	0.9	0.3	7.5
10 III				7.5	2.5	1.6	1.8	1.5	1.4	1.9	0.9	2.6	8.8
10 IV				3.8	3	1.8	2.1	1.3	1.4	3.9	2.9	6.9	9.7
10 V				3.3	4.4	1.3	1.4	1.7	1.6	1.9	0.7	-	-

1 From State of New York inspection reports
 2 No level taken
 3 Landfill subcell designation

be released from waste handling units. To determine whether SCA sufficiently characterizes waste it receives and records the disposal location, a review of preacceptance and tracking records for 23 waste loads received between June 1981 and June 1985, was conducted.

The 23 waste loads were systematically selected from summaries submitted to DEC. About four loads per year from 1981 to 1985 were selected from June receipts so that the 1985 receipts would be from just before inspection. Each of the four loads represented a different waste category including bulk liquids, drummed liquids, bulk solids and drummed solids. Final selection was based on whether the wastes should have required a detailed waste analysis during preacceptance testing, such as still bottoms.

The records indicate that, although the paperwork was not always fully completed, it was sufficient to identify the hazardous waste constituents in the wastes received and their disposal locations.

SITE HYDROGEOLOGY

Two major investigations have been conducted by SCA consultants to define the hydrogeologic setting of the Model City facility. The first investigative report was prepared by Wehran Engineering in 1977, the second by Golder Associates in 1985. The following information was derived from those reports unless otherwise noted.

The Model City facility is situated on the Ontario Plain, an area of low topographic relief between Lake Ontario to the north and the Niagara Escarpment to the south. Underlying the site is a 1,000-foot-thick sequence of red shale, siltstone and sandstone of the Queenston Formation. The Queenston Formation is overlain by about 30 to 60 feet of unconsolidated glacial till and glaciolacustrine deposits.

Regionally, ground-water flow is expected to be northward from the Escarpment toward Lake Ontario. Ground-water supplies are obtained principally from a fractured zone near the top of the shale and overlying unconsolidated deposits. The remainder of the Queenston Formation is almost impermeable. Well yields from the fracture zone and overlying deposits are marginally adequate for domestic needs.

In regard to required ground-water monitoring, the most important geologic units underlying the site are the unconsolidated glacial deposits because of their potential to transport leakage from the waste management units. The hydrogeology of these units has been well defined.

Data from 45 test pits and over 400 borings have been used to characterize the hydrogeology at the SCA facility. Most of the pre-1985 samples obtained from the test borings were split spoon samples taken at 5-foot intervals with some undisturbed (Shelby-tube) samples taken in key strata. In 1985, continuous soil samples were taken from 21 boreholes; disturbed samples were obtained with split spoon samplers and undisturbed samples from Shelby-tube samplers. In addition to the geologic logging of the glacial materials, about 150 field and laboratory permeability tests were performed.

HYDROGEOLOGIC UNITS

Both consultants to SCA (Wehran and Golder) identified the same principal hydrogeologic units [Figure 5]; however, different terms were applied to them, as follows:

Hydrogeologic Units	
Wehran Designation	Golder Designation
Zone 1	Upper alluvium Upper glacial tills
Zone 2	Middle silt till Glaciolacustrine clay
Zone 3	Glaciolacustrine silt/sand* Basal red till Shallow rock

* Wehran interprets this unit as fluvial, rather than lacustrine, in origin.

The ground-water monitoring plans for the facility and related regulatory documents use the Wehran unit designations. For ease of reference, those terms will be used elsewhere in this report when addressing the monitoring program. However, the Golder unit designations will be used in this discussion because they represent refined interpretations made from a more comprehensive data base than that available to the Wehran investigators.

The uppermost 5 to 10 feet of the Queenston shale (shallow rock) is generally highly weathered and fragmented. Where present, it is hydraulically connected to the overlying glacial deposits. In some places, the shallow rock is weathered so severely that it is difficult to distinguish from the overlying Basal Red Till.

The overlying Basal Red Till is nearly continuous and ranges up to 21.5 feet in thickness, with the typical thickness being about 5 feet. Its distinguishing characteristics are its reddish color and its hard, dry

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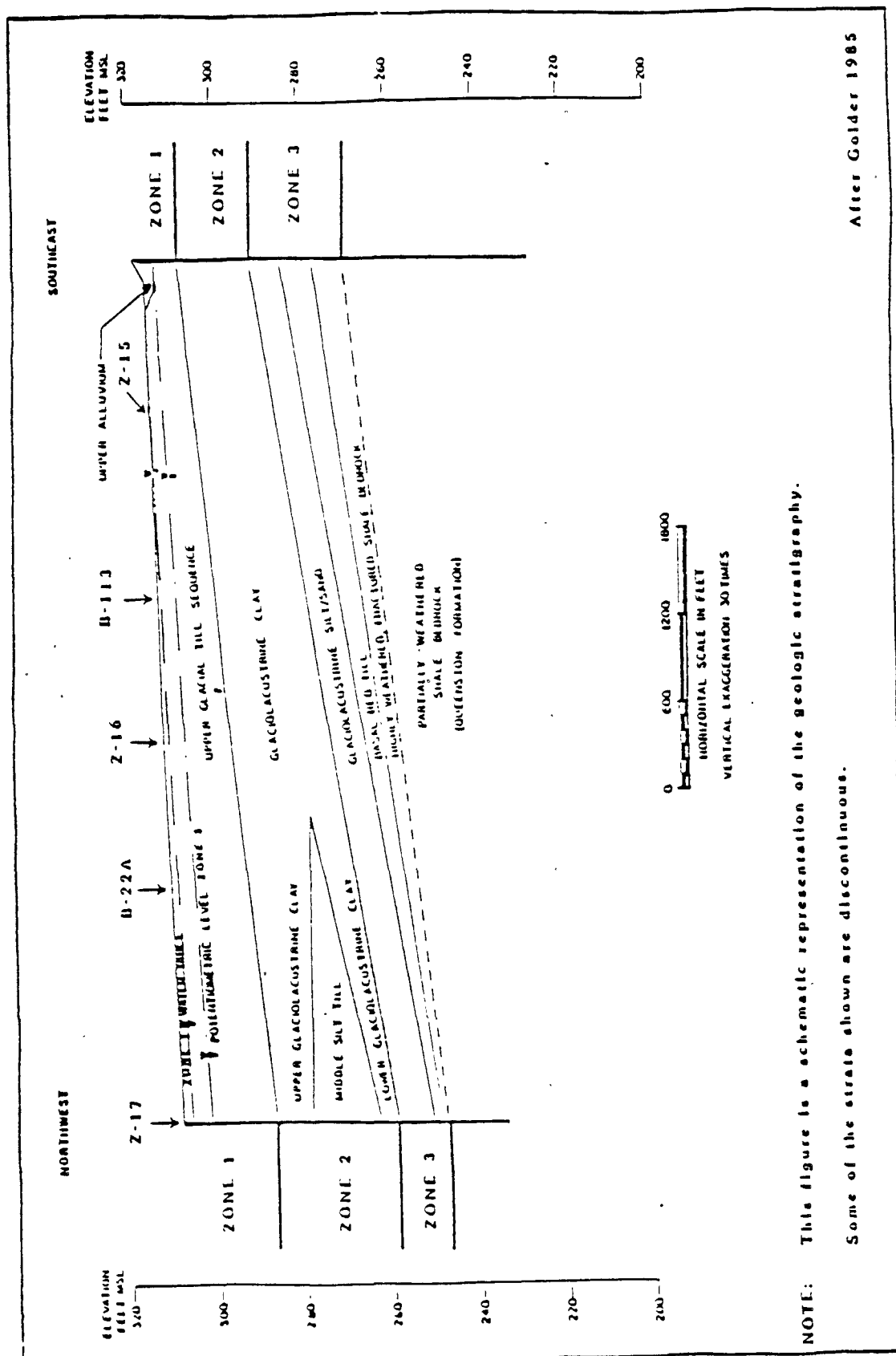


FIGURE 5 GENERALIZED SITE STRATIGRAPHY (Modified after Golder Associates)

indurated texture. It appears to be largely derived from the re-working of the underlying bedrock (Queenston shale).

Overlying the Basal Red Till is a 5 to 10-foot-thick varied sequence of Glaciolacustrine Silt/Sand, the coarsest and most permeable of the glacial deposits. It consists of brown, poorly sorted, fine to coarse sand and silt.

Overlying the Glaciolacustrine Silt/Sand unit is the Glaciolacustrine Clay which ranges from about 2 to 25 feet in thickness. In site boring logs, it is usually described as: "Very soft to firm, gray to gray-brown SILTY CLAY, trace fine sand". In the northwestern portion of the site, the Glaciolacustrine Clay is separated into an upper and lower member by up to 10 feet of silt till (Middle Silt Till). Its distinguishing feature is its characteristic gray color. A typical description from site boring logs is: "compact to very dense, gray to gray-brown SILT and coarse to fine SAND, trace to some fine gravel."

The Glaciolacustrine Clay is overlain by 15 to 20 feet of silt and clay tills (Upper Glacial Tills). These tills comprise most of the surface material at the Model City facility. The silt till is discontinuous throughout the site and is generally less prevalent in the southern portion. It is typically logged as: "compact to very dense, brown to purple-brown SILT, and coarse to fine SAND, little fine gravel. Contains occasional discontinuous, wet silt and sand layers".

The clay till is continuous across the site and overlies the silt till, where present. In the southern half of the site, it directly overlies the Glaciolacustrine Clay. The clay till is typically logged as: "stiff to hard, brown to purple-brown CLAYEY SILT, some coarse to fine sand, little fine gravel. Non-stratified to faintly laminated. Contains occasional cobbles and discontinuous, wet sand, gravel and silt layers."

On the surface of the clay till are discontinuous shallow pockets of fine sand, silt and clay alluvium. This unit is typically laminated and has a maximum thickness of about 5 feet.

The Glaciolacustrine Silt/Sand (Zone 3) is considered the uppermost aquifer by Golder and Wehran. It would be the only major pathway for leakage from the regulated units except that vertical recharge is restricted by the overlying Glaciolacustrine Clay and Middle Silt Till (where present). Further, the Upper Glacial Till unit (Zone 1) contains a free water table surface and is the first saturated permeable zone beneath the site.

Task Force personnel determined that both Zone 1 and Zone 3 need to be monitored. Zone 1 is a permeable saturated flow zone and monitoring wells completed in this zone are essential to ensure immediate detection of any statistically significant amounts of hazardous waste or hazardous waste constituents that might migrate from the waste management units.

GROUND-WATER FLOW DIRECTIONS AND RATES

Potentiometric contour maps were presented in the Golder report for the Upper Glacial Till (Zone 1) and the Glaciolacustrine Silt/Sand (Zone 3) based on January 1985 measurements. Golder's interpretation of the water level measurements, as illustrated by the contour maps, were confirmed by Task Force personnel.

The contour map for Zone 1 [Figure 6] suggests that horizontal ground-water flow is toward the north and northwest, following the slope of the ground surface. The water table surface is apparently controlled by topography and area drainage features and is locally affected by the facultative ponds and landfills. Generally, the water table surface is nearly parallel to the ground surface at a depth of about 3 to 5 feet.

The potentiometric contour map for Zone 3 indicates ground-water flow to the north and west [Figure 7], but regionally the flow is northward toward Lake Ontario. Golder attributes the local westwardly component of flow to an increase in thickness and permeability of Zone 3 in the northwestern portion of the site. In the central portion of the facility where the closely spaced contour lines indicate a steeper gradient, the thickness and permeability of the flow zone is lower than elsewhere.

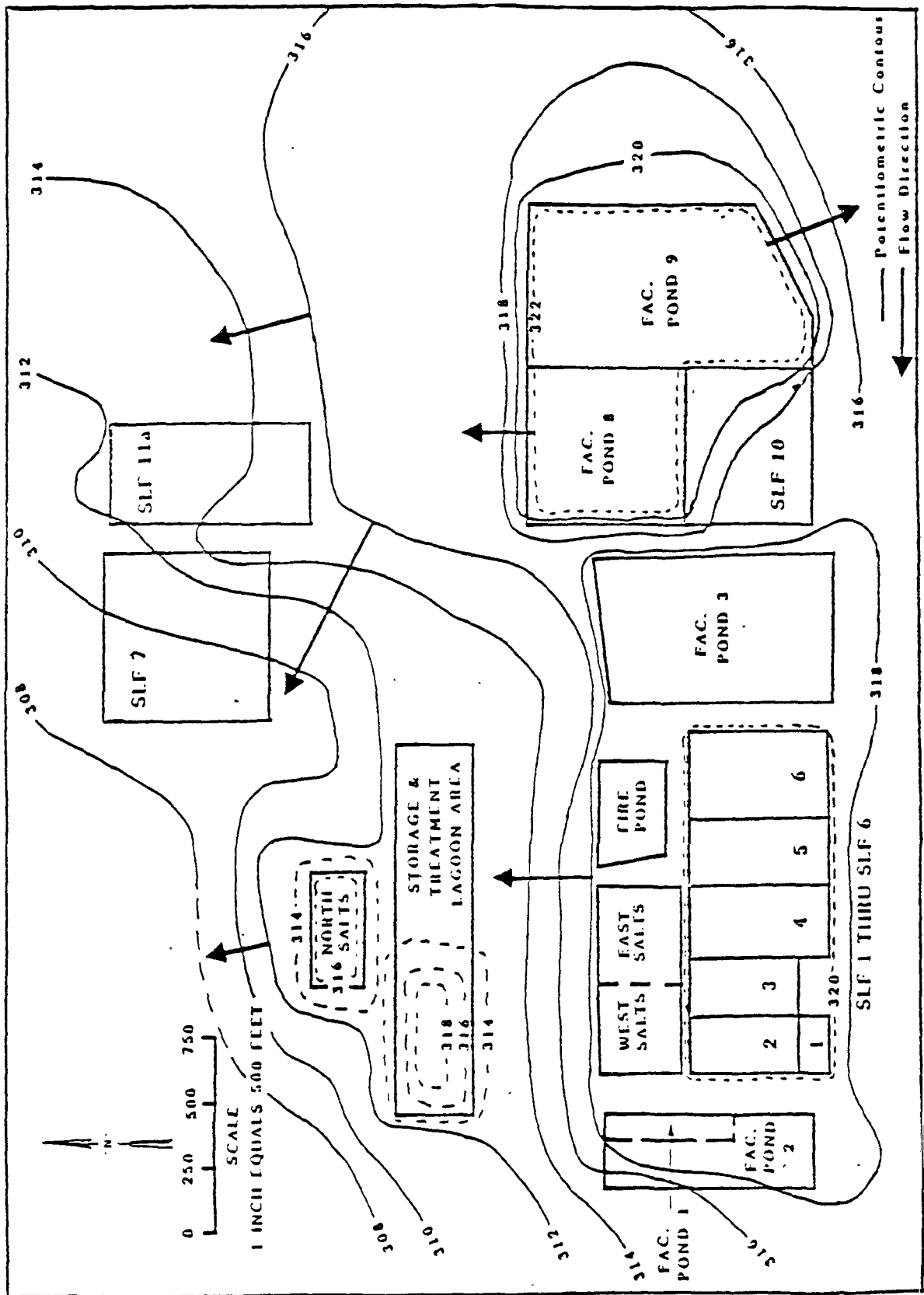


FIGURE 6 POTENTIOMETRIC CONTOUR MAP FOR ZONE 1 (Golder contours on active area base map)

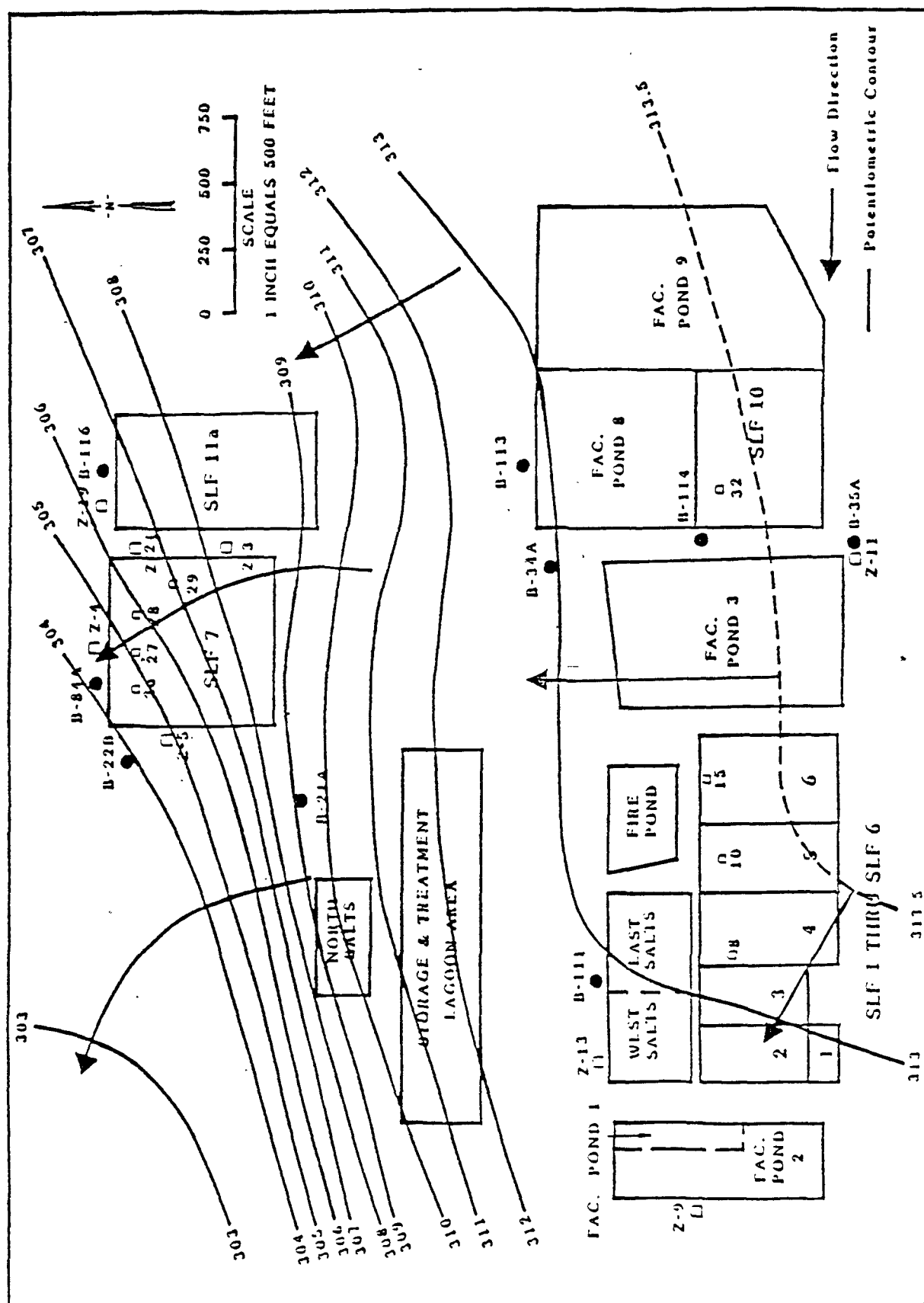


FIGURE 7 POTENTIOMETRIC CONTOUR MAP FOR ZONE 3 (Golder contour lines on monitoring well base map)

The permeability (hydraulic conductivity) of the various geologic units at the Model City site has been estimated by SCA consultants using three different methods. These are: (1) laboratory testing of "undisturbed" soil samples with the permeability measured primarily in the vertical direction, (2) *in situ* recovery tests and (3) indirectly, through sieve analysis of soil samples. A summary of the permeabilities for the various formations is presented in Table 16.

Estimated maximum ground-water flow rates [Table 17] were calculated using gradients and permeabilities of the hydrogeologic units determined by the SCA consultants. A comparison of the estimated vertical and horizontal flow rates for Zone 1 suggests that lateral flow is predominant, but is only marginally greater than the downward component. For the middle silt till (where present in Zone 2), the data suggest that the lateral flow is greater; however, downward flow in the glaciolacustrine unit is much greater than the lateral component. The data for Zone 3 are incomplete and a predominant flow direction is not suggested; however, horizontal flow is usually predominant in stratified sandy deposits such as those at the top of this zone.

In general, the comparison of vertical and horizontal flow rates suggests that in Zone 1 ground water flows both laterally and, to a lesser extent, downward to Zone 2. In Zone 2, where the middle silt till is absent, the flow is primarily downward to Zone 3, then primarily laterally. Therefore, both Zones 1 and 3 need to be monitored to ensure immediate detection of leakage from the regulated units.

Table 16
ESTIMATED PERMEABILITIES OF THE HYDROGEOLOGIC UNITS

Wehran Zonal Designation	Hydrogeologic Unit*	Maximum Permeability (cm/s)		Minimum Permeability (cm/s)		Mean Permeability (cm/s)	
		Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal
Zone 1	UA	1×10^{-5}	8×10^{-5}	1×10^{-5}	2×10^{-7}	1×10^{-5}	2×10^{-5}
	UGT	2×10^{-5}	8×10^{-5}	8×10^{-9}	5×10^{-8}	3×10^{-6}	7×10^{-6}
Zone 2	MST	3×10^{-7}	1×10^{-5}	3×10^{-8}	5×10^{-7}	2×10^{-7}	7×10^{-6}
	GC	7×10^{-8}	7×10^{-8}	1×10^{-8}	3×10^{-8}	2×10^{-8}	4×10^{-8}
Zone 3	GSS	-	$8 \times 10^{-4**}$	-	3×10^{-6}	-	9×10^{-5}
	BRT	6×10^{-8}	4×10^{-7}	9×10^{-9}	5×10^{-9}	4×10^{-8}	2×10^{-7}
	SR	3×10^{-4}	3×10^{-4}	5×10^{-8}	5×10^{-8}	5×10^{-5}	5×10^{-5}

NOTES:

* Golder designations of hydrogeologic units:

UA - Upper alluvium
 UGT - Upper glacial tills
 MST - Middle silt till
 GC - Glaciolacustrine clay
 GSS - Glaciolacustrine silt/sand
 BRT - Basal red till
 SR - Shallow rock

** Wehran estimated a maximum permeability of 3×10^{-1} cm/s from grain size distribution using Hazen's approximation.

Table 17
ESTIMATED MAXIMUM FLOW RATES

Wehran Zonal Designation	Hydrogeologic Unit*	Maximum Permeability, K (cm/s)		Maximum Gradient, i (ft/ft)		Maximum Flow Rate, V** (ft/yr)	
		Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal
Zone 1	UGT	2×10^{-5}	8×10^{-5}	0.04	0.015	8.0	12.0
Zone 2	MST	3×10^{-7}	1×10^{-5}	0.07***	0.005	0.21	0.5
	GC	7×10^{-8}	7×10^{-8}	0.58	0.001	0.41	0.001
Zone 3	GSS	-	8×10^{-4}	-	0.01	-	80.0
	BRT	6×10^{-8}	4×10^{-7}	0.13	0.004	0.08	0.02
	SR	3×10^{-4}	3×10^{-4}	-	0.01	-	30.0

NOTES:

* Golder hydrogeologic units:

UGT - Upper glacial tills

MST - Middle silt till

GC - Glaciolacustrine clay

GSS - Glaciolacustrine silt/sand

BRT - Basal red till

SR - Shallow rock

** $V = Ki/ne$, with n_e = effective porosity = 0.1

*** Estimated by Golder Associates

GROUND-WATER MONITORING PROGRAM DURING INTERIM STATUS

Ground-water monitoring at the SCA Model City facility has been conducted under both Federal and State interim status regulations. The following is an evaluation of the monitoring program between November 1981, when the ground-water monitoring provisions of the RCRA regulations became effective, and July 1985, when the Task Force investigation was conducted. This section addresses:

1. Regulatory requirements
2. Ground-water sampling and analysis plan
3. Monitoring wells
4. Sample collection and handling procedures
5. Sample analysis methods and data quality
6. Ground-water quality assessment program (implemented in 1983) and current outline

REGULATORY REQUIREMENTS

Regulatory requirements for ground-water monitoring at the Model City facility are complex and precepts have evolved since 1981 when the RCRA interim status provisions went into effect. This has resulted in SCA developing different monitoring well networks for State and EPA programs. The information presented here is included as a background for subsequent discussions of those well networks, compliance by SCA with the various monitoring requirements and the assessment program. A timeline of regulatory events related to ground-water monitoring is presented in Figure 8.

As of July 1985, a four-part regulatory framework controlled the design, installation and operation of the ground-water monitoring program at the SCA facility. These were: (1) facility requirements contained in the New York State Part 360 Regulations [360.8(c)(5)]*; (2) the general

* During the Task Force inspection, the State Part 360 regulations were re-codified with some modification into Part 373 regulations. The Part 360 regulations are cited in this report because they were the principal ones in effect during the period of interest.

Figure 8

TIMELINE OF REGULATORY EVENTS RELATED TO GROUND-WATER MONITORING
SCA Model City Facility

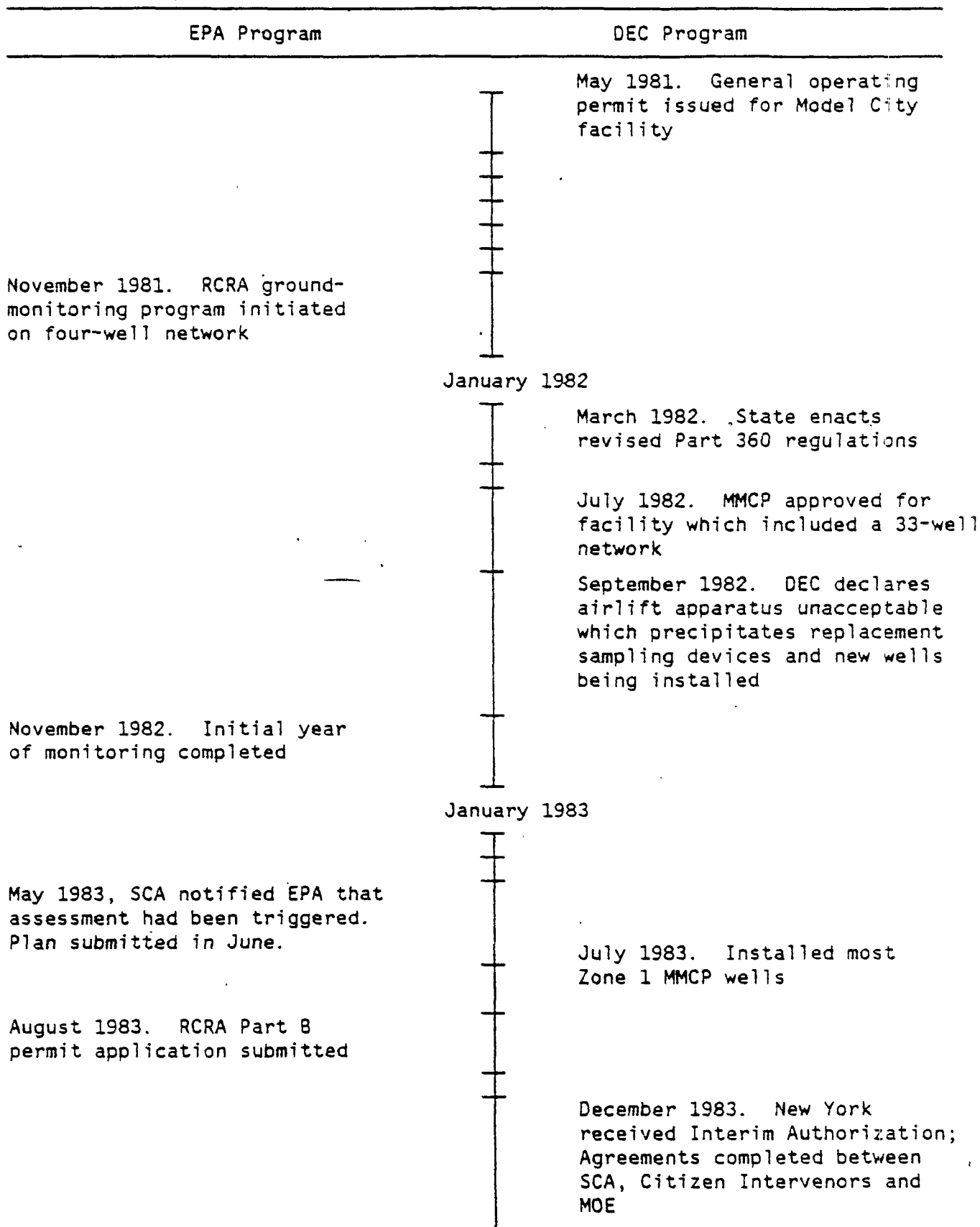
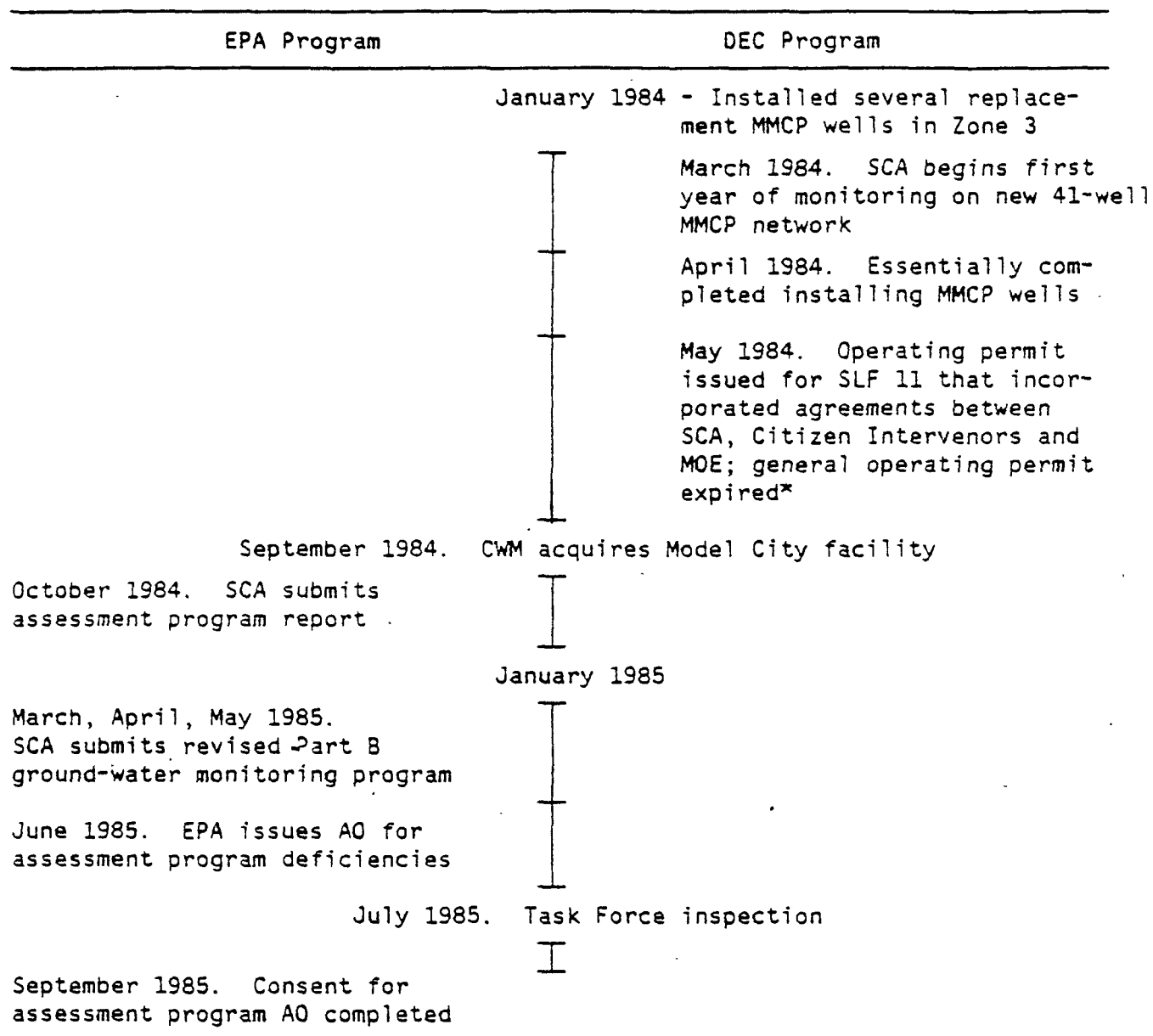


Figure 8 (contd.)



* Under State law, the permit remains in effect after expiration until a new one is issued. The permit expired in May 1984 and is being revised by DEC.

operating permit issued by the DEC that became effective May 1, 1981 (No. 2343) and the approved MMCP required by that permit; (3) the operating permit for SLF 11 (No. 3427), issued by DEC, which incorporates stipulations and agreements between SCA and the Ontario Ministry of the Environment and the Citizen Intervenor and (4) PCB disposal approvals issued by EPA Region II under authority of TSCA [40 CFR Part 761. 75(b)(6)].

State Regulations

The New York State Part 360 Facility Requirements (enacted in March 1982) for ground-water monitoring are nearly identical to, but broader in scope than, the RCRA Part 265, Subpart F interim status requirements. The substantive differences are that the State can require ground-water monitoring of (1) facilities other than surface impoundments, landfills and land treatment areas (areas covered by RCRA regulations), (2) water-bearing zones other than the uppermost aquifer, and (3) separate waste management components, even if they are within a line circumscribing several units. Further, PCB wastes are covered by the State hazardous waste disposal regulations; there is no State counterpart to TSCA. Regulation counterparts are shown in Table 18.

Table 18
STATE AND FEDERAL COUNTERPART INTERIM STATUS REGULATIONS

Subpart Title*	New York State Regulation (360.+)	RCRA Regulation (40 CFR Part)
Applicability	8(c)(5)(i)	265.90
Ground-water Monitoring System	8(c)(5)(ii)	265.91
Sampling and Analysis	8(c)(5)(iii)	265.92
Preparation, Evaluation and Response	8(c)(5)(iv)	265.93
Reporting and Recordkeeping	8(c)(5)(v)	265.94

* Subpart titles are the same in both the State and RCRA regulations.

General Operating Permit and MMCP

As previously noted, the DEC issued a general facility operating permit to the Model City facility in 1981. Special Condition 8 of that permit required SCA to submit an MMCP to the Department for approval. The monitoring program in that plan was to cover "groundwater quality and hydrology for every water bearing zone beneath the facility. . .". Further, "this monitoring program shall include locations upstream and downstream of each separate site operation. . ." and, finally, "the MMCP shall include sampling schedules, sampling methods, analytical parameters and other pertinent information". Once approved, the MMCP procedures became, in effect, permit conditions that must be followed.

When the DEC received Interim Authorization in December 1983, the MMCP became, in effect, the ground-water sampling and analysis plan required by State regulations. The June 1982 MMCP, approved by the State on July 29, 1982, included the RCRA Part 265, Subpart F ground-water monitoring requirements (although not the specific monitoring well network) and additional State-required monitoring parameters [Table 19]. It did not, however, incorporate the ground-water monitoring requirements for PCB disposal approvals SLFs 7 and 10.

Table 19

ADDITIONAL STATE-REQUIRED GROUND-WATER MONITORING PARAMETERS LISTED IN JUNE 1982 MMCP

Ammonia	Zinc
Copper	Total organic-chlorine scan
Cyanide	PCBs*

* *To be tested for if individual peaks in the total organic-chlorine scan are greater than 10 ppb or the total of all peaks is greater than 25 ppb*

The environmental monitoring section of the approved MMCP was revised in July 1984 to include the new SLF 11 State permit requirements and the EPA PCB disposal approval monitoring requirements for SLFs 7, 10 and 11. During the Task Force inspection, SCA personnel stated that the revised

MMCP is currently being followed by the facility. Although DEC effected the revised plan, it was never approved.

Operating Permit for SLF 11

On May 26, 1984, DEC issued an operating permit (No. 3427) for SLF 11. The permit incorporated, by reference, ground-water monitoring requirements developed with public participation during the application review process. The public participants, including the Canadian Ontario Ministry of the Environment (MOE) and a group (Citizen Intervenors), comprising members of Operation Clean, Pollution Probe and Operation Clean-Niagara, had requested a public hearing on the application. To avoid a potentially protracted hearing, the MOE and Citizen Intervenors negotiated separate stipulations and agreements with SCA that included ground-water monitoring around the new landfill. Those agreements were incorporated into the permit for SLF 11.

Together, the stipulations and agreements require a minimum of 14 Zone 1 trench wells and eight Zone 3 wells to be placed around SLF 11, with at least five of the Zone 1 wells and three Zone 3 wells to be constructed around Section A (SLF 11a). The wells around SLF 11a were to be completed by April 15, 1984.

Further, the agreements stipulated that the wells were to be monitored for volatile and organic constituents identified now or in the future in 40 CFR 122, Appendix D, Table 2 (Organic Toxic Pollutants in Each of Four Fractions in Analysis by Gas Chromatography/Mass Spectroscopy). Currently, the referenced table contains 110 organic compounds.

PCB Disposal Approvals

The Model City facility currently has three PCB disposal approvals (for SLF 7, 10 and 11), each of which requires ground-water monitoring [Table 20]. Monthly reports are submitted to EPA Region II for ground-water and other monitoring required by the disposal approvals.

Compliance with the monitoring requirements of the PCB disposal approvals is not specifically addressed in the following text because those requirements were incorporated into the revised MMCP and the scope of the Task Force inspection related, principally, to RCRA requirements.

Table 20

SUMMARY OF PCB DISPOSAL APPROVAL GROUND-WATER MONITORING REQUIREMENTS

Secure Landfill	Designated Monitoring Wells	Monitoring Parameters	Monitoring Frequency
SLF 7	B-21 ^a , B-22, B-32, B-33 ^a	PCB, pH, specific conductance, chlorinated organics	Monthly until closure, then semiannually
SLF 10	B-35, B-43, B-113 ^b , B-114 ^b , Z-12, Z-15	PCB, pH, specific conductance, volatile chlorinated organics	B-wells quarterly until closure; Z-wells semiannually until closure; for post-closure monitoring, see disposal approval
SLF 11a	B-32A, B-33A, B-115, B-116, Z-3, Z-19, Z-20, Z-21, Z-22, Z-23 ^c	PCB, pH, specific conductance, volatile chlorinated organics	B-wells quarterly until closure; Z-wells semiannually until closure; for post-closure monitoring, see disposal approval

a PCB Disposal Approval for SLF 7, condition number 7, requires the submission of a proposal for installation of a minimum of one additional downgradient monitoring well (Region II records).

b Wells B-113 and B-114 were designated as a result of Approval Condition I.A in the PCB Disposal Approval for SLF 10.

c Well no longer exists; it was removed during construction of cell 11b and will reportedly be reinstalled at a new location.

To summarize, as of July 1985, the SCA interim status ground-water monitoring program was subject to both Federal and State requirements, disposal approvals and permits, and was to be conducted in accordance with the June 1982 MMCP approved by DEC. Monitoring parameters include those contained in (1) the State counterparts of the RCRA Part 265, Subpart F regulations plus six added by the DEC, (2) 40 CFR Part 122, Appendix D, Table II, pursuant to the operating permit for SLF 11 and (3) the PCB disposal approvals.

GROUND-WATER SAMPLING AND ANALYSIS PLAN

Since the effective date of the RCRA ground-water monitoring requirements (November 19, 1981), SCA Model City has developed and followed eight documents composing at least three monitoring plans. Until early 1985, the plans did not adequately describe sample collection, handling and analysis procedures and, in some cases, the procedures defined were deficient.

The plan being followed in July 1985, although not a single document, generally meets the State regulatory requirements for sample collection, handling, shipment, analysis and chain-of-custody. It specifies, however, filtering of samples for most parameter analyses, which is unacceptable to the State and EPA because the resulting data may be biased low.

The following describes each of the plans and discusses the deficiencies.

Plan Under EPA/RCRA Regulations (1981-1983)

By November 1981, SCA had developed a monitoring plan, titled "Ground-water Monitoring Program, Model City, New York Facility, SCA Chemical Services, Inc., Boston, Massachusetts - Owner and Operator", to meet EPA requirements. The 18-page plan, provided to Task Force personnel by SCA, addressed all the Subpart F provisions. A review of the plan and subsequent monitoring reports revealed several inconsistencies with the RCRA regulations.

First, the monitoring well network, described on page 5 of the SCA plan, included three identified wells (B-35, B-22 and B-49) and one unidentified downgradient well, all in Zone 3. The unknown well was subsequently identified in the first quarterly report as B-42 (described below). These four wells [Figure 9] composed the RCRA-required monitoring network until December 1983 as indicated by the four quarterly and two subsequent semi-annual monitoring reports. None of the downgradient wells were at the limit of the waste management area as required by 265.91(a)(2). Placement of wells adjacent to the waste management area is essential, not only to satisfy

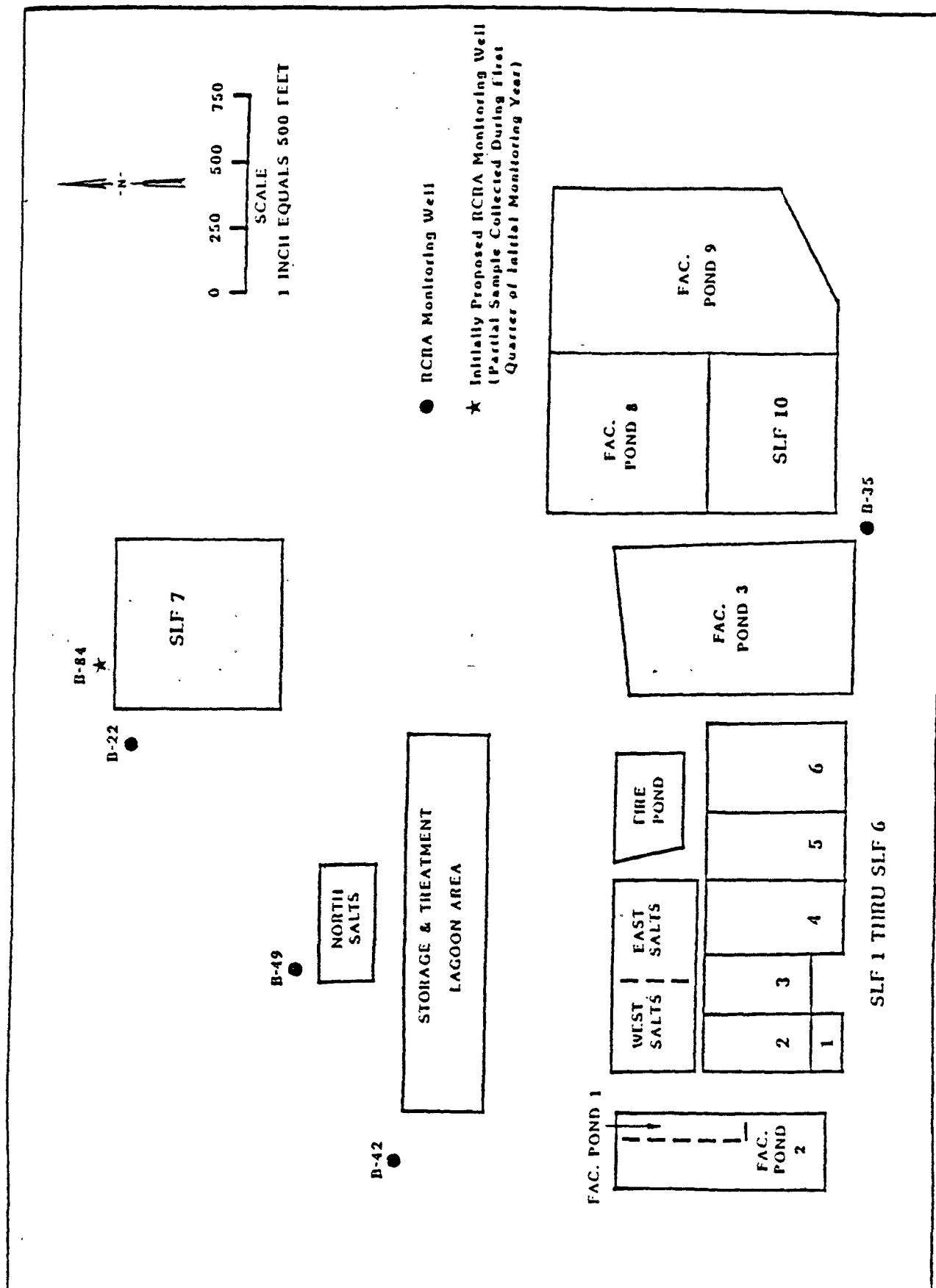


FIGURE 9 INTERIM STATUS MONITORING WELL NETWORK (1981-1983)

the regulatory requirement, but to minimize the chance of erroneously triggering assessment monitoring as a result of detecting chemicals from pre-RCRA site activities.

The monitoring well locations indicate that the entire site was considered as one large waste management area pursuant to 265.91(b)(2), in marked contrast to the four management areas described in the concurrent MMCP, as discussed below. Further, the number and locations of monitoring wells were not adequate to ensure immediate detection of statistically significant amounts of hazardous wastes or hazardous waste constituents migrating from the waste management area to the uppermost aquifer, also required by 265.91(a)(2). For example, if waste constituents were leaking from near the northern side of SLF 7 or Facultative Ponds 1 and 2 [Figures 7 and 9], they would not be detected by any of the three downgradient wells, all of which are in Zone 3.

The monitoring well sampling method was inadequate because it involved the use of an "air lift apparatus". The parameters used as indicators of ground-water contamination, including pH, specific conductance, total organic carbon (TOC), and total organic halogen (TOX) [265.92(b)(3)], are all sensitive, especially pH, to the vigorous aeration caused by the air lift apparatus. Concentrations and values can change significantly as a result of the aeration.

If pH changes occur, change in specific conductance is likely. If organics were leaching from the management units, volatiles would likely be the first to arrive at the monitoring wells. Volatiles could be easily stripped from the sampled water by the air lift apparatus and would be reflected in decreased TOX and, possibly, TOC concentrations.

All methods used for analysis are not specified, as required by RCRA regulations [265.92(a)]. Page 10 of the SCA plan states "Unless otherwise noted, the [analytical] procedures outlined in the following documents will be used for the appropriate parameters". The two listed documents are compilations of "standard methods", which together did not contain analytical

procedures for all of the monitoring parameters, such as TOX. Also, citing general analytical methods is not acceptable because those methods often have alternate subparts that can yield significantly different results for the same sample.

The first quarterly report, dated May 18, 1982, revealed that the unidentified well, discussed above, was initially B-84 but, midway through the quarterly monitoring, was changed to B-42. Tables submitted in that report show some analytical results listed under B-42 with a footnote indicating that they were actually from a B-84 sample. Well B-84 is on the north side of and adjacent to SLF 7 and well B-42 is 2,200 feet southwest of B-84 near the northeast corner of salts area 7; yet the report presents the data as if the wells were adjacent or equivalent. Such data do not adequately establish background concentrations as required by 265.92(c).

In summary, during interim status ground-water monitoring under RCRA, the Model City facility did not develop an adequate ground-water sampling and analysis plan, nor did it have properly located or a sufficient number of monitoring wells. Other problems are described in the section on sample analysis and data quality.

Plan Under DEC/State Regulations (1984-1985)

Under the State Part 360 regulations, like the Federal counterparts, a facility must develop and follow a ground-water sampling and analysis plan. Additionally, the general operating permit for the Model City facility requires approval of the plan [MMCP] by the DEC. By July 1985, when the Task Force inspection was conducted, the State-approved plan had been outdated and SCA was following a piecemeal "plan" composed of at least five documents, none of which had been approved by the DEC.

Notwithstanding the lack of approval by DEC, procedures described in the July 1985 "plan", except for filtering of samples, were judged acceptable. The piecemeal nature of the plan was not acceptable.

When New York received Interim Authorization on December 27, 1983, the then-current monitoring plan at the Model City facility (under State regulations and permit) was the June 1982 MMCP. The June 1982 MMCP was approved (referred to as the approved MMCP) by the DEC following extensive public participation and an adjudicatory hearing. The approved MMCP was accepted, at the time, as satisfying State monitoring requirements.

The monitoring well network described in the approved MMCP, however, was not completed until the summer of 1983 (except for one well); then it was overhauled. Wells having PVC casings were replaced with wells cased with stainless steel and new wells were installed adjacent to SLF 11. Further, in September 1982, DEC notified SCA that the air-lift devices used for sample withdrawal were not acceptable. As new wells were constructed, Geomon[®] units (described in the subsection on Monitoring Wells) were installed. The new wells were completed, except for B-112, by April 1984 (in accordance with the MOE and Citizen Intervenor agreements).

As a result of these changes, the initial year of monitoring required by State regulations [360.8(c)(5)(iii)(c)] did not begin until March 1984. Therefore, the relevant period for assessing the ground-water sampling analysis plan under the State program was from March 1984 to the time of inspection (July 1985).

With all the changes to the well network and sample collection devices, the approved MMCP was partially outdated when the initial year of monitoring began in March 1984. To account for these changes, SCA developed and followed three other documents during 1984, which superceded the ground-water monitoring section of the approved MMCP. Only one was a revision to the MMCP and, according to SCA personnel, it was never approved by DEC. After CWM acquired SCA in late 1984, sampling and analysis procedures (presented in three CWM documents*), superceded respective parts of the SCA documents.

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* Two of these documents were authored by the contractor laboratory (ETC) for CWM and the other by its parent company, WMI.

In some instances, procedures were implemented before a written plan was developed. These plans are discussed below.

Between February and October 1984, SCA developed and followed a ground-water sampling and analysis plan consisting of three SCA documents:

1. Air, Surface Water and Ground-water Monitoring Plan, SCA Chemical Services Inc., Model City, New York (a revised version of the monitoring section of the approved MMCP) dated July 1984
2. SCA Quality Assurance Manual for Groundwater Monitoring dated February 24, 1984
3. Standard Laboratory Methods for SCA Model City dated October 1984

Document 1 above (referred to as the revised MMCP) presented a framework for the State-required monitoring program including a new well network, a generic monitoring schedule and general monitoring procedures. Program details for sampling are presented in the Quality Assurance Manual and analytical methods are presented in the Standard Laboratory Methods volume. These documents are not referenced in the revised MMCP as being part of the monitoring plan; however, they were the written plans that were being followed.

The monitoring well network had changed significantly in the revised MMCP to include (1) many new wells, some of which were first and second generation replacements for those identified in the June 1982 MMCP and (2) a fifth Facility Process Area (FPA V - encompasses SLF 11). The revised network includes 24 wells in Zone 1 and 19 in Zone 3, as discussed in the following subsection on monitoring wells.*

A principal problem with the revised MMCP (and the approved MMCP) is the inadequate monitoring program for the Zone 1 wells. The inadequacy

* Of the 19 Zone 3 wells listed in the revised MMCP, one (well B-112) was destroyed in 1983 and never reconstructed.

arises from differing interpretations of the regulation and the precepts followed when the 1982 MMCP was approved. The revised MMCP (authored by SCA) states, on page 60, that "because Zone 1 is not an aquifer in the conventional sense, RCRA* requirements for sampling frequencies and parameters do not apply".

The interpretation, stated in the revised MMCP, poses two problems. First, the resulting data base for the Zone 1 wells is much less than it would be if State interim status monitoring requirements were followed. Secondly, no procedure is clearly indicated by which data comparisons between upgradient and downgradient wells would be made and assessment monitoring triggered, if leakage were indicated by the data.** Current precepts and interpretations of the site hydrogeology and regulatory requirements by Task Force personnel indicate that Zone 1 should be monitored in accordance with the State interim status requirements (i.e., in the same manner as Zone 3 wells).

Sample collection equipment was also changed in the revised MMCP. The air-lift apparatus was replaced with a gas-driven Geomon sampler unit. The suitability of this device was never demonstrated by SCA as indicated in an October 1984 letter from DEC to EPA [Appendix D].

The SCA Quality Assurance Manual for Groundwater Monitoring is much more comprehensive than the approved MMCP. It addresses areas such as well development, purging, sample collection, preservatives, depth-to-water measurements, field notes, preparation of sample bottles, bottle labeling, chain-of-custody, sample shipments, personnel training and the sampling schedule (minus the starting date). Special sample handling procedures are described for volatile organics, total organic halides and coliform bacteria.

* The reference to RCRA is a carryover from the approved MMCP. The reference should be to State requirements.

** No statistical data comparisons for Zone 1 wells have been reported to the State.

The subjects were covered in moderate detail. Sample bottle labeling is a potential problem, however, as bottles are marked for each sampling point only when initially prepared (some bottles are reused; therefore, they become dedicated to a monitoring point). No additional labeling was reportedly done as samples were collected. The date, time and sampling point should be shown on a bottle label each time a sample is collected. With the large number of sampling points, the potential for exceedance of holding times and sample mix-ups is greatly increased under the system described. Also, no custody seals are mentioned for samples shipped offsite for analysis.

The document "Standard Laboratory Methods for SCA Model City" was not completed until October 1984, 7 months after the initial year of monitoring was begun. Neither the approved nor the revised MMCP listed specific analytical methods to be used for ground-water samples. Therefore, procedures were implemented before a written plan was developed. An evaluation of the methods followed is presented in the section on sample analysis and data quality.

In July 1985, during the Task Force inspection, the facility ground-water sampling and analysis plan included unspecified parts of the following documents:

1. SCA Quality Assurance Plan for Groundwater Monitoring dated February 24, 1984
2. Revised MMCP dated July 1984
3. WMI Manual for Groundwater Sampling, undated
4. Laboratory Standard Operating Procedures as amended February 21, 1985
5. Data Integration Standard Operating Procedures dated June 10, 1985

This loose amalgamation of documents does not constitute an acceptable plan for the facility, as required by the operating permit and State regulations [360.8(c)(5)(iii)(a)]. The contents and relation of these plans are discussed below.

From December 1984 to July 1985, following acquisition of SCA by CWM, CWM sampling and analysis procedures were phased in at the Model City Facility. Again, the MMCP was not amended to reflect the changes made. The CWM corporate procedures for sample collection, handling and documentation (field records and chain-of-custody) are described in the "WMI Manual for Groundwater Sampling".*

A copy of the WMI Manual for Groundwater Sampling was provided to Task Force personnel and declared "business confidential" pursuant to 40 CFR Part 2.203; consequently, discussion of that document in this report will be limited.

The WMI Manual for Groundwater Sampling includes 89 pages of narrative and two appendices. It describes sample collection, handling, field records and chain-of-custody in great detail; however, the sampling procedures are not site specific. Omitted are a listing of the designated monitoring network wells, sampling schedules derived from the various regulatory requirements, and procedures for operating the Geomon sampling systems. These items are, however, presented in two SCA documents (revised MMCP and Quality Assurance Manual) previously discussed.

The "Laboratory Standard Operating Procedures" by ETC is a 509-page document that describes chain-of-custody, sample collection, analytical methods and quality assurance. The manual, provided to Task Force personnel, was updated October 31, 1984 and amended February 21, 1985. The amended version includes a description of sample management through the laboratory and many of the specific instrument operating procedures. A second manual entitled "Data Integration Standard Operating Procedures, June 10, 1985," also by ETC, describes procedures for sample management and data processing to the report stage. This second manual also contains information on quality control procedures and procedures not presented in the former manual.

* WMI (Waste Management, Inc.) is the parent company of CWM.

Detailed methods for chloride, nitrate, sulfate, phenol, sodium, TOX, TOC, gross alpha and gross beta are not contained in the manuals. Further, ETC subcontracts analyses and the methods used by the subcontractors are not included. For example, the metals digestion used by one subcontractor is not the one contained in the ETC manual. The ETC manual allows clients to ship samples for dissolved metals analysis to the lab with a maximum elapsed time of 48 hours before filtration and preservation. This procedure is inappropriate; however, it is not followed by CWM personnel (filtering is done within 2 hours of sample collection). EPA recommends* filtration for samples being analyzed for dissolved constituents followed by preservation as soon after sampling as is practical.

MONITORING WELLS

The monitoring well network currently in use at the facility has also evolved considerably since 1981. Although well construction, in most cases, is adequate, the current (July 1985) number and locations of monitoring wells are not sufficient to ensure immediate detection of leakage from all of the regulated units. The entire current well network is to be replaced in the near future with a more comprehensive system (see section "Groundwater Monitoring Program Proposed for RCRA Permit"). Because the new system has not been installed, deficiencies of the system being used in July 1985 are discussed below. The following information was obtained from boring logs and well completion/certification reports unless otherwise noted.

An elevation survey of existing wells, reported to SCA in September 1984, lists 55 wells including 24 in Zone 1 and 31 in Zone 3. Of these, the revised MMCP monitoring network currently contains 23 in Zone 1 and 18 in Zone 3 [Figure 10]. Zone 1 wells are designated by the letter "Z" and Zone 3 by the letters "B" or "W".

* "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, as referenced in 265.92(a)

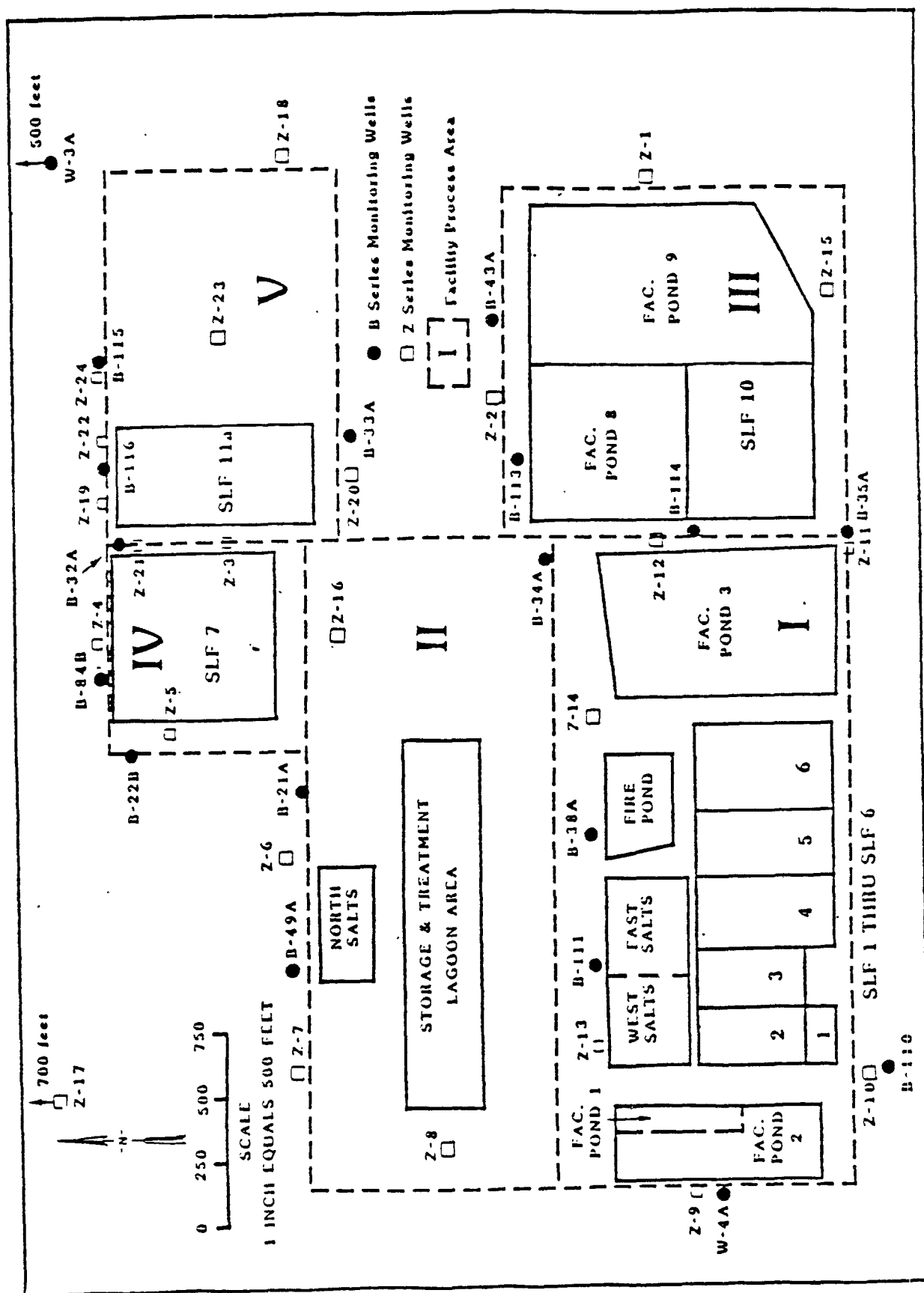


FIGURE 10 CURRENT INTERIM STATUS MONITORING WELL NETWORK

Well Construction

The current Zone 1 monitoring wells are constructed in trenches [Figure 11].* The trenches, in which the wells were installed, were constructed with a backhoe and are generally about 20 feet deep, 15 feet long and 3 feet wide.

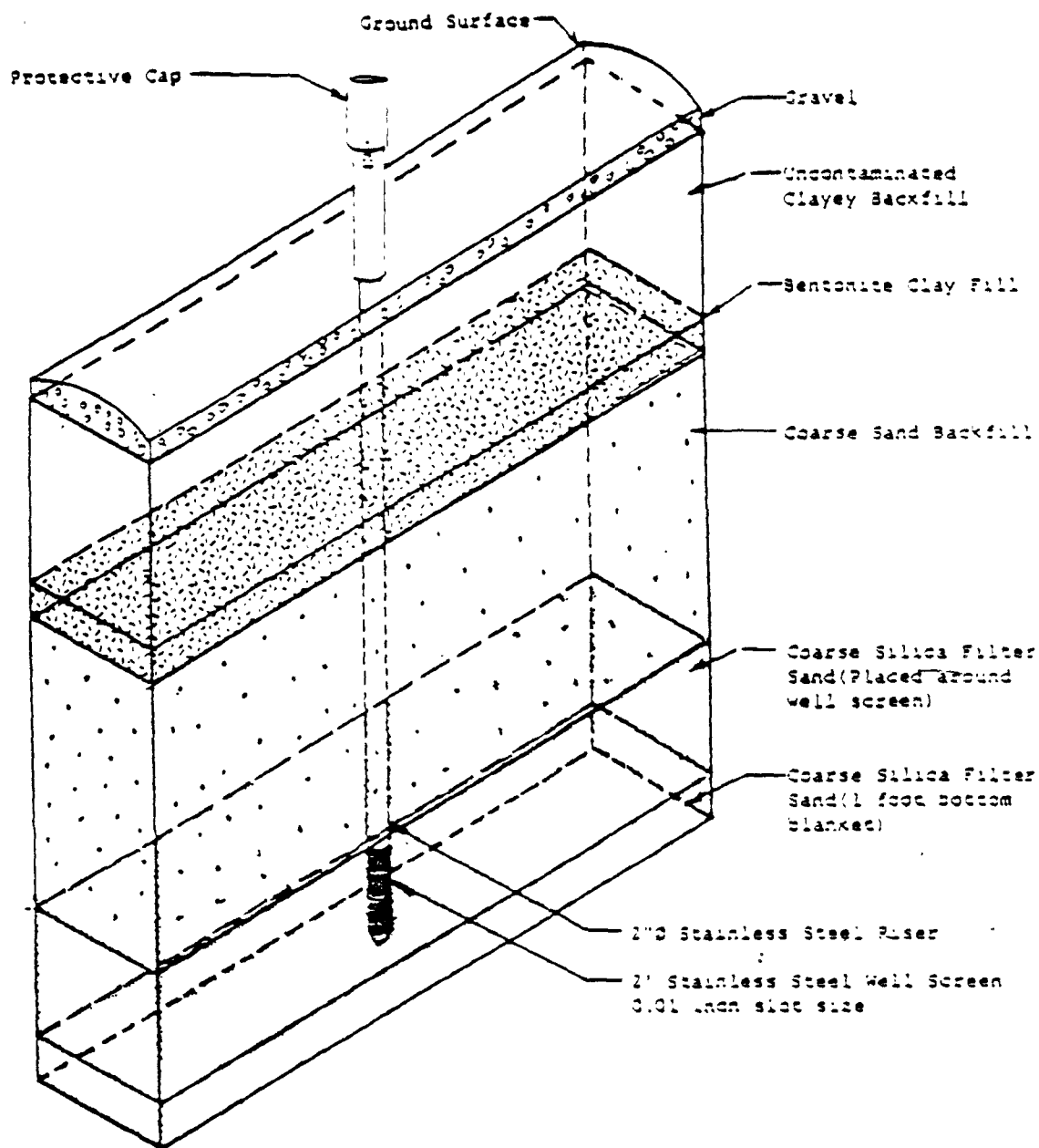
The Zone 3 wells were generally constructed in 8-inch diameter boreholes using rotary and hollow-stem auger drilling methods. The annular space (space between the casing and borehole) above the sand pack was filled with a bentonite-cement grout; in some wells a bentonite-pellet seal was installed between the sand pack and grout [Table 21].

Monitoring network wells are constructed of 2-inch diameter stainless steel casing and screens and have locking well-head caps. The screen slot size is 0.010-inch (10-slot); screen length in Zone 1 wells is 2 feet and in Zone 3, with three exceptions, is 5 feet. The exceptions are wells B-49A, B-110 and B-111, which have screen lengths of 2, 15 and 14 feet, respectively. Additional well construction details are presented in Table 21.

During 1984, the monitoring network wells were equipped with dedicated Geomon samplers [Figure 12], which are positive displacement gas driven units constructed of Teflon. The Geomon sampler is enveloped in a sand pack inside the well casing; no details were provided on the vertical location of the sampler inlet in each well. During purging and sampling, gas pressure (from a high pressure nitrogen tank) is applied to a down-the-hole cylinder, which closes a bottom check valve and forces water up the sampling line. When the pressure is relieved, the check valve opens and allows ground water to recharge the cylinder. The principal advantage of the Geomon sampler over the air-lift device is that the sample is not vigorously aerated during collection.

* Well Z-23 was constructed as a shallow version of the Zone 3 wells; however, it was removed during the construction of SLF 11b.

FIGURE 11 TRENCH WELL MONITORING DEVICE FOR ZONE 1



Reference: Detail modified from
MMCP Report, November 1991

TRENCH WELL INSTALLATION
SCA Chemical
Lawiston, New York

Table 21
SCA MODEL CITY FACILITY
INTERIM STATUS MONITORING WELLS

Well	Zone Monitored	Date Installed	Bottom of Screen (ft.)	Sand Pack Length (ft.)	Pipe Joints	Annular Space Seal Material	Well Development
Z-1	UGT, GC	7/5/83	20.8	16.0	F	Clay over bentonite	Unknown
Z-2	UGT, GC	7/5/83	20.9	15.5	F	Clay over bentonite	Unknown
Z-3	UGT, GC	7/7/83	20.9	16.3	F	Clay over bentonite	Unknown
Z-4	UGT, GC	4/84	21.5	16.0	W	Clay over bentonite	"
Z-5**	UGT, GC	7/1/83 and 4/84	21.5/25.5	13.8	W	Clay over bentonite	Unknown "
Z-6	UGT, GC	7/1/83	20.9	15.6	F	Clay over bentonite	Unknown
Z-7	UGT, GC	7/1/83	20.9	15.5	F	Clay over bentonite	Unknown
Z-8	UGT, GC	7/1/83	21.0	15.5	F	Clay over bentonite	Unknown
Z-9	UGT, GC	7/5/85	21.9	15.5	F	Clay over bentonite	Unknown
Z-10	UGT, GC	7/5/83	20.9	15.5	F	Clay over bentonite	Unknown
Z-11	UGT, GC	7/5/83	20.9	16.5	F	Clay over bentonite	Unknown
Z-12	UGT, GC	7/23/83	Unknown***	Unknown	Unknown	Clay over bentonite	Unknown
Z-13	UGT, GC	7/7/83	20.8	15.5	F	Clay over bentonite	Unknown
Z-14	UGT, GC	7/7/83	20.9	16.6	F	Clay over bentonite	Unknown
Z-15	UGT, GC	7/23/83	15.5	10	Unknown	Clay over bentonite	Unknown
Z-16	UGT, GC	7/1/83	20.9	17.3	F	Clay over bentonite	Unknown
Z-17	UGT, GC	7/8/83	29.4	25.5	F	Clay over bentonite	Unknown
Z-18	UGT, GC	7/1/83	20.8	15.7	F	Clay over bentonite	Unknown
Z-19	UGT, GC	4/84	23.5	13.9	W	Clay over bentonite	"
Z-20	UGT, GC	4/84	24.7	10.8	W	Clay over bentonite	"
Z-21	UGT, GC	4/84	22.4	9.0	W	Clay over bentonite	"
Z-22	UGT, GC	4/84	22.0	10.6	W	Clay over bentonite	"
Z-23****	Destroyed	4/23/84	20.5	12.0	W	Bentonite clay cement over bentonite pellets	"
Z-24	UGT, GC	4/84	24.7	12.3	W		
B-21A	SR, BRT	6/3-6/83	41.0	7.4	F	Bentonite clay grout	"
B-22B	SR, GSS	1/23/74	45.0	5.0	W	Bentonite cement over bentonite pellets	"
B-32A	SR, GSS	4/10/84	43.0	13.5	W	Bentonite cement over bentonite pellets	"
B-33A	SR, GSS, GC	4/16/84	44.1	10.0	W	Bentonite clay grout over bentonite pellets	"
B-34A	GSS	1/12-16/84	42.9	16.0	W	Bentonite cement over bentonite pellets	"
B-35A	SR, BRT, GSS	1/16-17/84	35.4	15.6	W	Bentonite cement over bentonite pellets	"
B-36A	SR, GSS	1/10-12/84	45.8	15.0	W	Bentonite cement over bentonite pellets	"
B-43A	BRT, GSS	1/20-23/84	40.5	17.2	W	Bentonite cement over bentonite pellets	"
B-49A	SR	6/7-8/93	43.0	4.3	F	Bentonite clay grout	"
B-54B	SR, BRT	1/17/84	46.4	10.3	W	Bentonite cement over bentonite pellets	"

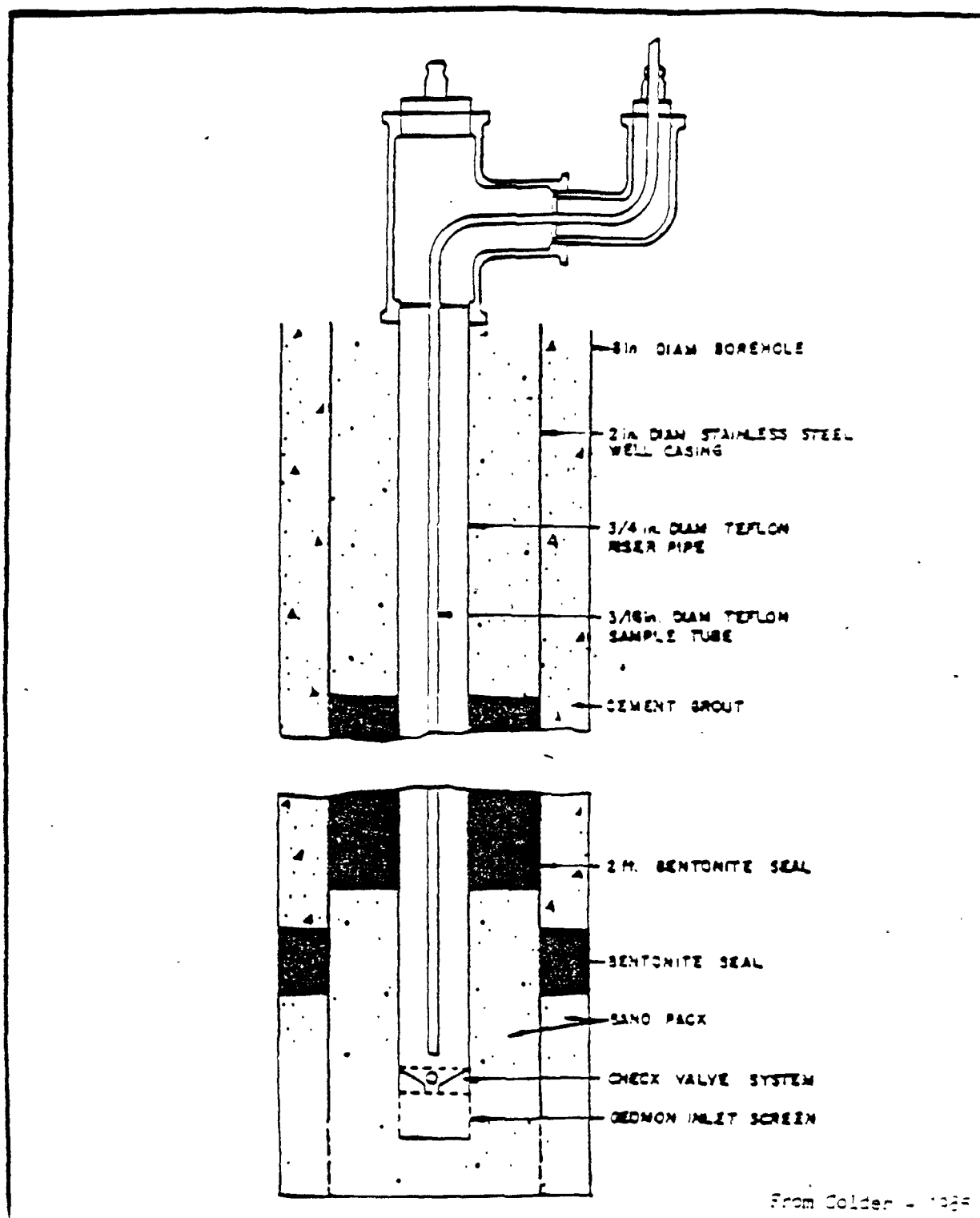


FIGURE 12 SCHEMATIC OF GEOMON SAMPLING SYSTEM
USED AT MODEL CITY FACILITY

Based on the well logs and completion reports, the Zone 3 monitoring wells are adequately constructed, completed and, in most instances, developed. The Zone 1 wells are adequately constructed and completed; development information is deficient. Construction-related problems have been noted at some wells; however, the effects are either negligible or could be remedied through replacement or modification. For example, wells B-34A, B-35A, B-49A, B-110 and B-111 have yielded high pH samples (pH 8 to 12) that were attributed to the bentonite-cement grout. Some of the wells sampled as part of the inspection were excessively turbid indicating either improper construction (sand pack deficiencies) or development.

Well Locations and Number

The principal problems with the current monitoring well network are deficiencies in locations and number of wells. Many of the downgradient wells are not located close enough to the waste management areas nor are there a sufficient number to ensure immediate detection of chemicals migrating from those areas to the uppermost aquifer. State regulations [360.8(c)(5)(ii)(a) and (b)] require that downgradient monitoring wells be installed at the limit of the waste management area. At facilities having multiple waste management components subject to ground-water monitoring requirements, such as the Model City facility, the waste management area is described by an imaginary line which circumscribes several components.

Accordingly, SCA has divided the site into five "Facility Process Areas" (FPAs), as previously noted. Under present precepts, the FPA boundaries are too far away from the waste management units to constitute the circumscribing line, as described in the regulations. At facilities having only one unit subject to ground-water monitoring requirements, the waste management area is described by the waste boundary. By analogy, the downgradient side of the circumscribing boundary lines at the Model City facility should be the waste boundaries (with allowance for containment structures), which is where the wells should be installed.

At FPA I [Figure 10], the designated downgradient Zone 3 wells (revised MMCP) are W-4A, B-38A and B-111. Of these, B-38A is not close enough to

the adjacent waste management unit (the fire pond, which is currently used as a facultative pond). Zone 1 wells, located to detect leakage from FPA I units, include Z-9, Z-12, Z-13, and Z-14. Of these, Z-14 is not sufficiently close to the adjacent waste management unit. Further, the number of wells is not sufficient to immediately detect leakage from all or major portions of the following units:

1. Facultative pond 1
2. Facultative pond 2
3. SLFs 1 through 6
4. Facultative pond 3

At FPA II, the designated downgradient Zone 3 wells are B-21A, B-49A and B-112. Of these, only B-49A is downgradient from any of the waste management units and it is about 100 feet from the nearest unit (north salts area). Well B-112 was removed during drainage improvement work in 1983 and currently does not exist. None of the Zone 1 wells, located downgradient from FPA II units, including Z-6, Z-7, Z-8 and Z-16, are close enough to the waste management units. The number of wells is not sufficient to immediately detect leakage from all or major portions of the following units:

1. North salts area
2. Lagoons 1, 2, 5 and 6
3. Salts area 7
4. Tank 58

At FPA III, the designated downgradient Zone 3 wells are B-34A, B-43A, B-113 and B-114. Of these, only B-113 and B-114 are at the limit of the waste management area. The three waste management units in this FPA share common dikes and are essentially one unit so that all have at least one well located downgradient for leak detection. The average space between the wells is about 425 feet, which may not ensure immediate detection of leakage, as suggested by modeling conducted by an SCA consultant* during

* See section on "Ground-Water Monitoring Program Proposed for RCRA Permit".

the spring of 1985. Zone 1 wells that could detect leakage from FPA III units include Z-1, Z-2 and Z-12. Well Z-12 is in FPA I, as previously noted. Neither Z-1 nor Z-2 is at the waste management area boundary; they are the width of a road (about 50 feet) away.

At FPA IV, which includes only SLF 7, the designated downgradient Zone 3 wells are B-22B and B-84B. Of these, only B-84B is at the limit of the waste management area and is clearly downgradient. A potentiometric map of the glaciolacustrine silt/sand (Zone 3), contained in the March 1985 hydrogeologic report by Golder Associates, suggests that well B-22B would not be in the flow path of any leaks emanating from SLF 7. Further, B-22B is about 125 feet west of the SLF 7 perimeter dike. Zone 1 wells, located to detect leakage from SLF 7, include Z-3, Z-4, Z-5 and Z-21. All are sufficiently close to the landfill.

Finally, at FPA V, which includes only SLF 11a at present, the designated downgradient MMCP and operating permit* wells are B-32A, B-115 and B-116. None are at the limit of the waste management area; the wells are about 50 feet away. The average spacing between the wells is about 350 feet (300 and 400 feet), which may not ensure detection of leakage as suggested by site modeling conducted by an SCA consultant (discussed in the RCRA Permit section). There are five Zone 1 wells, near SLF 11a, as required by the permit (Z-3, Z-19, Z-20, Z-21 and Z-22). Wells Z-3, Z-21 and B-32A are so close to SLF 7 that they may not be effective monitors for leakage from SLF 11a. The well network to be constructed in the near future should allay this problem.

SCA SAMPLE COLLECTION AND HANDLING PROCEDURES

During the inspection, samples were collected from 17 wells for analysis by an EPA contractor laboratory. At each of these wells, SCA personnel also collected samples using their standard procedures, which were observed by Task Force personnel. With the exception of filtering of most sample

* Includes MOE and Citizen Intervenor agreements

aliquots and disposal of purge water, the SCA (WMI) procedures for sample collection, documentation, handling, preserving, shipping and chain-of-custody were acceptable. The procedures also conformed to those described in relevant parts of the "WMI Manual for Groundwater Sampling" and the "SCA Quality Assurance Plan for Groundwater Monitoring", previously discussed (i.e., Company personnel were following the developed plan).

The Company has a training program to ensure that the procedures are properly and uniformly implemented. Model City personnel received 2 days of sampling training by CWM staff during the spring of 1985. Each CWM and SCA facility reportedly has staff or contractors dedicated to environmental monitoring so that only trained people do the work, thereby assuring more consistency in sampling. The general sampling procedure used at each well is described in the Investigation Methods section of this report. Some of the details are described and evaluated here.

At the well head, the first step in the sample collection procedure is to measure depth to water through the Geomon access port (the surveyed reference point). Next, the volume of water in the casing is calculated using the depth to water measurement, total well depth (from construction records) and casing diameter. Purge volumes are calculated by multiplying the volume of water in the casing by three.

The volume of water calculation does not involve subtracting the space occupied by the sand-pack inside the casing around the Geomon sampler. Therefore, more than three times the volume of water actually inside the casing were removed, but how much more is not known as no records of the sand pack, if any were kept, are consulted. The procedure itself is satisfactory; however, it is not documented in the revised MMCP, Quality Assurance Manual or the corporate monitoring plan. A change in sampling personnel could result in different procedures being followed, resulting in different variabilities in the data.

Water purged from the wells is discharged to the ground nearby. This is not a good practice as the water may contain contaminants and remedial action or appropriate closure may be required for the affected areas.

Field measurements were being satisfactorily performed for pH, specific conductance and temperature with a Hydac[®] meter. Following purging of each well at the beginning of sample collection, a small (about 250 ml) plastic beaker is rinsed three times with water discharged from the well, then filled for taking the field measurements. Each measurement is repeated four times with the meter probe rinsed with deionized water and dried with a disposable laboratory wipe between each reading. The results are recorded on a field record form (CC-2) provided by the contractor laboratory. The field meter is calibrated every 4 hours or 10 wells, whichever comes first.

After making the field measurements, samples are collected for analysis by the SCA contractor laboratories. SCA practice is to fill sample bottles for "total" type analyses (e.g., total organic carbon and total organic Halogen) and volatile organics directly from the Geomon teflon discharge line. Samples for all other analyses, including extractable organics, are initially pumped into either new 1-gallon amber glass jugs or 1-liter plastic bottles (called "filtration bottles") depending on the analyses to be conducted. The sample in the filtration bottles is taken to an onsite laboratory where it is placed in a teflon-lined pressure vessel and run through a 142 millimeter diameter, 0.45 micron filter, into the appropriate sample container. Samples are to be filtered and preserved within 2 hours of collection.

Filtering of the samples for organics and metals is unacceptable. Filtering of sample aliquots for organics analysis contradicts a May 3, 1985 statement by the DEC regarding "Policy on Altering Water Samples to be Analyzed for Organic Compounds" [Appendix E]. Although EPA has no formal

[®] Hydac is a registered trademark hereafter used without the ®.

policy on filtering samples for organics and metals, the Agency is on record as opposing such practice.* The principal objection is that the results may be biased low.

The sample bottles are all prepared by the principal contractor laboratory, ETC, in Edison, New Jersey, to ensure uniform procedures. The bottles are pre-labeled for the required parameters from each sampling point and shipped to the facility in sealed "shuttles" together with the required documents for sampling (chain-of-custody and field record sheets - documents CC-1 and CC-2, respectively). Pre-measured preservatives for each sample bottle are either shipped in the bottle or in small vials attached to it.

Once the samples are collected, filtered (where done) and preserved, they are placed in the shuttles, which are insulated containers with fitted plastic foam inserts for the bottles. Then, "blue ice" packs, frozen in an onsite freezer, are placed in the shuttles to cool the samples during shipment. After completing and enclosing the sampling documents, the shuttle is secured with a numbered plastic seal and shipped to the laboratory.

SAMPLE ANALYSIS AND DATA QUALITY EVALUATION

This section provides an evaluation of the quality of interim status ground-water monitoring data gathered by SCA between November 1981 and July 1985 when the Task Force inspection was conducted. Analytical procedures for ground-water samples and data quality were evaluated through laboratory inspections and review of documents containing the required monitoring data. The SCA onsite laboratory and two SCA contractor laboratories were evaluated in mid-July 1985. The evaluations included reviewing laboratory

* June 1985, Memorandum Number 7 by David Friedman, "Notes on RCRA Methods and QA Activities" and recent Agency decisions on ground-water analyses conducted by Hooker at Love Canal in New York

operating and analytical procedures, internal data reports, raw data and quality control records; interviewing key laboratory personnel; and inspecting analytical equipment.

The inspection revealed that pre-1985 data were often of poor analytical quality, incomplete and inadequate. Data derived from present (July 1985) laboratory procedures are much improved although some analytical inadequacies still exist.

Most of the ground-water samples collected between 1981 and early 1985 were analyzed at the SCA onsite laboratory. Radiation analyses were performed by Control for Environmental Pollution, Inc., in New Mexico and fecal coliform analyses were performed by ACTS Laboratory in New York. Pesticide and herbicide analyses were performed by the onsite laboratory; the SCA Research and Development Laboratory in Buffalo, New York; and Ecology and Environment, Inc., also in Buffalo. The majority of the volatile and semi-volatile organic analyses were performed by the SCA Research and Development Laboratory and Ecology and Environment, Inc. Mead Compuchem in North Carolina occasionally performed some organic analyses.

Presently, Environmental Testing and Certification (ETC) Laboratory in New Jersey is responsible for all ground-water analyses; however, sampling personnel perform pH, conductance and temperature measurements in the field. ETC subcontracts metals and other (chloride, sulfate, phenol, etc.) analyses to General Testing Laboratory in New York and radiation analyses to Core Laboratories in Wyoming.

Monitoring Under the EPA/RCRA Program (1981-1983)

In November 1981, SCA initiated quarterly monitoring, pursuant to 265.92(c) on the RCRA well network. As previously noted, the network comprised four wells including B-35 (upgradient), B-22, B-42 and B-49. Four quarterly monitoring reports, two semiannual reports and associated laboratory records were reviewed for this well network. The reports were found to lack some of the required data and contained biased or suspect data.

RCRA regulations [265.92(c)] require quarterly monitoring for the first (initial) year of all wells to establish background concentrations or values. Quarterly monitoring of the upgradient wells must include quadruplicate measurement of the four parameters used as indications of ground-water contamination (pH, specific conductance, TOC and TOX). After the first year, each well must be sampled at least semiannually.

All the analyses required during the initial year of monitoring (November 1981 to October 1982) were not performed. TOX data were not obtained for the first two quarters and no TOX data were reported for the second semiannual monitoring for the upgradient well. The first quarterly report contained no data for endrin, lindane, methoxychlor and toxaphene for well B-35 and most parameters were not determined for B-42. The first semiannual monitoring report contains no data for any of the drinking water parameters [265.92(b)(1)]. The first quarterly report contains no data for five of the six ground-water quality parameters [Part 265.92(b)(2)] for well B-42 and the first semiannual report contains no data for any of these parameters.

Quadruplicate measurements of the four indicators' parameters for each sample were often not obtained. For example, in the third quarter, TOC values ranging from 4 mg/l to 97 mg/l were reported for well B-49 and pH values of 7.2 to 8.1 were reported for well B-22. Data reported for well B-22 in the second semi-annual report for pH ranged from 7.47 to 8.27 and conductance ranged from 1,121 $\mu\text{hos/cm}$ to 4,313 $\mu\text{hos/cm}$. These ranges were not obtained from replicate analyses of a sample but from analyses of a number of samples.

Some data were derived from samples collected before or after the monitoring period and from wells other than the designated wells. For example, data for samples collected on May 11, 1983 and December 9, 1983 are reported in the semiannual report for the period May 19, 1983 to November 19, 1983. This report also contains data for both well B-49 and well B-49A, all reported as data for well B-49. In the first quarterly report, data for samples collected from well B-84 are listed with data for well B-42, as previously noted.

Large variations in parameter concentrations and values were noted in the SCA ground-water sampling results. Most of this variability is attributed to sample handling and/or laboratory procedures, rather than actual changes in ground-water quality. For example, duplicate pH measurements for a sample collected from upgradient well B-35 on March 11, 1983, were 7.63 and 7.12. Good duplicate measurements should vary by no more than 0.1 pH units.

Conductance values of 1,210 and 5,650 $\mu\text{mhos/cm}$ were reported for the first and second quarters, respectively, for well B-22. The first and second quarter chloride concentrations for this well were 1,700 and 1,260 mg/l , respectively. Conductance should be greater than the sum of the major cation and anion concentrations; in this case, the conductance for the first quarter sample is less than one of the major anion concentrations.

Similarly, analytical or reporting error is probably the cause of outlier sodium values obtained during the second quarter. For example, in well B-49 samples, sodium concentrations for the four quarters were 260, 0.16, 125 and 190 mg/l , respectively. The second quarter sodium concentrations for all wells were less than 1 mg/l . All of the subsequent SCA data are consistent with the higher values. For the second semiannual samples, a sodium concentration of 4,750 mg/l is reported for well B-49, which is about twice the conductance value of 2,400 $\mu\text{mhos/cm}$.

TOC concentrations were determined with a method that was inappropriate for the organic carbon levels present and the samples analyzed were filtered. Thus, only dissolved organic carbon was determined. The organic carbon was calculated from the difference between total carbon and inorganic carbon determinations. When the inorganic carbon makes up most of the total carbon, the analysis variability becomes a significant factor and results in large systematic biases. TOC should have been determined by measuring nonpurgable organic carbon and purgable organic carbon. Systematic errors are evident in the data between quarters for a well. For example, the average values reported for the second and third quarters for well B-35 were 36 mg/l and 1.5 mg/l , respectively.

The TOX data reported for the third and fourth quarters of the initial year of monitoring are suspect because of the large differences observed between quarters. Systematic bias is suggested by the data for wells B-42 and B-49. TOX values of 3.6 µg/l and 63.6 µg/l, respectively, were reported for well B-42 while <0.1 µg/l and 110 µg/l were reported for well B-49. Experience indicates that the best detection limit achievable by the TOX method is about 5 µg/l. The variation in the quadruplicate measurements made on each of the third and fourth quarter samples for well B-35 indicate that the detection limit actually achieved in the analyses was about 30 µg/l. The TOX averages for the third and fourth quarters for well B-35 (23 µg/l and 8.6 µg/l, respectively) and the third quarter for wells B-42 (3.6 µg/l) and B-49 (<0.1 µg/l) are lower than the detection limit and, therefore, unreliable.

State and EPA regulations require analysis of ground-water samples for total organic Halogen. The analytical method used to measure total organic Halogen concentrations is called total organic halide (TOX).^{*} During the first year of monitoring, SCA performed an analysis that was called total organic Halogen (TOH). Although the analytical method has the same name as the required monitoring parameter, they are different. In the quarterly reports, TOH results were inappropriately mixed with TOX results.

The TOH analysis method evolved from a screening test for PCBs required by the State and consisted of analyzing a solvent extract by gas chromatography. By contrast, the TOX analysis method involves absorption of organics on activated carbon, combustion of the activated carbon, and coulometric titration of the evolved halides. TOH results, therefore, are not equivalent to TOX results and do not satisfy the regulatory monitoring requirements for TOX.

Samples collected for the eight metals on the drinking water parameter list [265, Appendix III] were filtered before analysis, thereby generating data for dissolved metals instead of total. Drinking water standards are

^{*} EPA publication SW-846, "Test Methods for Evaluating Solid Waste," July 1982, Method 9020

based, however, on total metals [40 CFR Part 141.23(f)]. Therefore, the SCA analytical methods are not consistent with those required for drinking water supplies.

The methods used to determine arsenic, chromium and selenium resulted in unreliable data. Arsenic and selenium were determined without digestion by hydride generation atomic absorption spectroscopy. EPA-approved hydride generation methods require digestion. Chromium was determined with an inappropriate oxidant in the fuel/oxidant mixture for the flame atomic absorption spectroscopy analysis. EPA methods specify nitrous oxide/acetylene while SCA used air/acetylene. The practices cause results to be biased low.

The flame atomic absorption spectroscopy methods, used by SCA, for cadmium, chromium and lead did not achieve reliable results near the drinking water limits for these parameters. For example, in 1983, an EPA performance evaluation sample containing 0.38 mg/l lead was analyzed and a value of 0.17 mg/l was obtained. Similarly, in 1982, an EPA sample containing 0.70 mg/l chromium was analyzed and a value of 0.47 mg/l was obtained. Detection limits commonly given in SCA laboratory records were about 0.02 mg/l to 0.04 mg/l for cadmium, 0.1 mg/l to 0.2 mg/l for chromium and 0.1 mg/l to 0.3 mg/l for lead. The drinking water standards for cadmium, chromium and lead are 0.01 mg/l, 0.05 mg/l and 0.05 mg/l, respectively.

Much of the Gross Alpha and Gross Beta data could not be used to determine the suitability of the ground water as a drinking water supply. The confidence intervals reported with the data are frequently larger than the measured values or render data so imprecise as to preclude meaningful comparison with the drinking water limits. The analyses should have had longer counting periods to obtain better confidence intervals.

Initial Year of Monitoring Under State Program
(March 1984 Through February 1985)

In March 1984, the first year of monitoring under State regulations was started. The first three quarterly reports and supporting laboratory records revealed that data for many of the wells are inadequate for establishing background levels. The laboratory findings discussed above are also applicable to these quarterly data, as most of the methods did not change.

Present Laboratory Procedures (July 1985)

Some inadequacies in the present laboratory procedures were found. One major inadequacy is that samples for semivolatile organics, pesticides and herbicides are filtered prior to extraction. This practice may result in data biased low for these parameters. Similarly, samples are filtered before metal analyses; thus, dissolved instead of total, metals are determined.

ETC Method GC/MS-1-002 for base, neutral and acid extractable organics, pesticides and PCBs is not recommended by the Task Force for analysis of ground-water samples for pesticides and PCBs. The detection limits achieved for the pesticides and PCBs by this method are about 50 times higher than those achieved by gas chromatography-electron capture detector methods.

The flame atomic absorption spectroscopy methods used to determine cadmium, chromium and lead do not reliably measure levels near the drinking water limits for these parameters. Detection limits indicated in Company records were at the drinking water limits. Measurements near the detection limits are not reliable because of high variability. These analyses need to be performed by furnace atomic absorption spectroscopy.

The analytical procedure for TOC is incomplete because the results represent only nonpurgable organic carbon. Samples are acidified and purged with nitrogen gas prior to determination of organic carbon, which results

in the loss of purgable (volatile) organic carbon. Analysis must be made for purgable and nonpurgable organic carbon and the concentrations summed to calculate a result for total organic carbon.

ETC performs TOX analyses near an area where samples are extracted with methylene chloride. This practice is cautioned against by the instrument manufacturers as the activated carbon used in the TOX analysis is highly susceptible to contamination by fugitive organic vapors. Data from ETC activated carbon blanks indicates a detection limit of about 20 µg/l was achieved on samples. TOX analyses need to be performed in an area isolated from the use of solvents. After the Task Force inspection, ETC reportedly moved the TOX analytical equipment to an area isolated from solvent handling.

GROUND-WATER ASSESSMENT PROGRAM AND OUTLINE

Data derived from samples obtained during the initial year of monitoring under RCRA regulations and the first semi-annual samples triggered assessment monitoring at the Model City facility. SCA submitted an Assessment Plan to EPA, implemented that plan and prepared a report that presented findings and specified additional necessary work.

During the conduct of the Assessment Program under RCRA, New York received Interim Authorization. Soon after delegation, SCA began the initial year of monitoring on the MMCP wells for which assessment had not been triggered. Under the State requirements, the assessment program outline is contained in the revised MMCP.

The following discussion addresses significant events pertaining to the Assessment Program conducted under RCRA regulations to explain the current status and provides an evaluation of the revised MMCP Assessment Program Outline.

Assessment Program Under RCRA

During the initial year of monitoring under RCRA (November 1981 - October 1982), the RCRA regulations [265.92(c)] required the Company to develop a background database. Background data is derived from samples taken quarterly for one year (initial year); after the initial year, samples for indicators of ground-water contamination (indicator parameters) are to be collected semi-annually. If statistically significant differences between the background data for indicator parameters from upgradient wells and subsequent data from downgradient wells are identified and confirmed, an assessment program is required [265.93].

Assessment monitoring was triggered at the Model City facility by the first semi-annual samples (for the period November 1982 to May 1983) for the following wells and parameters:

Well	Parameters
B-22	Specific conductance and TOX
B-42	pH
B-49	pH

On June 20, 1983, SCA transmitted an Assessment Program Plan to EPA Region II, which presented a two-phase approach. The objective of the first phase was to determine or explain the differences in ground-water quality during the interim status ground-water monitoring program. If hazardous waste or hazardous constituents (contaminants) were detected, a second-phase study would be conducted to determine the rate and extent of contaminant migration and contaminant concentrations, as required by 40 CFR Part 265.93(d)(4).

The Assessment Program Plan stated that the elevated pH and specific conductance values had been sufficiently explained in a May 6, 1983 letter to EPA and no further work was planned. The letter attributed the high values to natural variations in water quality. Although the explanation is plausible, the poor quality of the data (previously discussed) makes the conclusion suspect.

The plan focused on verifying the high TOX value in B-22. A new well, RB-22 was to be constructed and, together with B-22, sampled for volatile organic priority pollutants. The resulting data would be compared to similar data from SLF 7 leachate and evaluated.

An Assessment Program Report on Phase 1 studies was submitted to EPA 16 months later, on October 15, 1984. The report stated that samples from B-22 and RB-22 (designated in the report as B-22A) had unspecified anomalous pH values; well B-22A was subsequently replaced with B-22B. Volatile organic priority pollutants were not detected in either B-22 or B-22B. The

report further stated that the anomalies in pH data from wells B-22 and B-22A would be investigated.

In June 1985, just before the Task Force inspection, Region II issued a complaint/compliance order to SCA, based on State regulations, for deficiencies in the assessment plan and report. The complaint cited violations of requirements to:

1. Notify the State Commissioner of the statistical increase of certain indicator parameters
2. Prepare a plan that specifies (1) the number, location and depth of wells, (2) sampling and analytical methods, and (3) implementation schedule
3. Determine the rate and extent of migration
4. Determine the concentration of hazardous waste or hazardous waste constituents in ground water
5. Submit the assessment report as soon as technically feasible
6. Submit an Annual Report to the State Commissioner containing the assessment program results

Substantive discussions on the order were not begun until after the Task Force inspection. A consent agreement addressing the violations noted in the complaint was completed on September 30, 1985.

MMCP Outline for the Ground-Water Quality Assessment Program

The outline for the ground-water quality assessment program, presented in the revised MMCP is incomplete. The outline should describe a more comprehensive ground-water monitoring program than the program in place.

One-half page of narrative in the revised MMCP (page III-42) presents the assessment program outline. The narrative states that, initially, the source of the contamination will be identified and isolated. This will be accomplished by (1) increasing the parameter analysis specific to the likely source area, (2) obtaining soil samples in a grid pattern between the source

area and contaminated well, (3) placing additional wells to evaluate the extent of contamination and (4) increasing the sampling frequency.

Further, the revised MMCP states that contamination would likely be first detected in Zone 1 (which was not defined as the uppermost aquifer by SCA during the inspection); therefore, initial efforts would be in defining contamination in that zone. If data suggest contamination in Zone 3, additional monitoring wells would be installed.

The MMCP outline needs to be revised to include:

1. Whether or how data triggering assessment would be evaluated to confirm the apparent contamination
2. How the apparent source would be determined
3. Whether or how additional hydrogeologic data would be collected
4. How the rate and extent of contaminant migration would be determined
5. Which aquifer zones would be monitored
6. How a monitoring plan would be developed and what the projected sampling frequency would be
7. Which analyses would be conducted on ground-water and soil samples to identify contaminants of concern
8. Analytical methods to be used on the samples
9. How the data would be evaluated to determine if more work is required or the facility could return to the indicator evaluation program
10. Approximate time frames for sampling, analysis, data evaluation and report preparation

GROUND-WATER MONITORING PROGRAM PROPOSED FOR RCRA PERMIT

In August 1983, SCA submitted the ground-water monitoring portion of the Part B RCRA permit application to EPA Region II; a copy was also provided to DEC as the State-issued General Operating Permit for the facility was due to expire the following May.* Through a series of meetings between EPA, DEC and SCA, the Company was informed of deficiencies in the proposed program. Among these deficiencies were the following:

1. Number and location of wells inadequate
2. Site hydrogeologic characterization inadequate
3. Compliance boundary not adequately defined
4. Choice of indicator parameters not justified
5. Statistical techniques not acceptable
6. Use of downgradient wells as background wells unacceptable
7. Use of air-lift apparatus unacceptable
8. Geomon devices may not be acceptable, use not adequately justified
9. Methods for determining ground-water flow rates are unacceptable
10. Sample collection procedures unacceptable

No substantive revisions were made in the Part B ground-water monitoring program until after the CWM takeover in late 1984. In the spring of 1985, SCA submitted the three following documents as a revision to the Part B application:

1. Hydrogeologic Characterization, Chemical Waste Management, Inc., Model City, New York Facility, dated March 1985 by Golder Associates
2. Evaluation of Groundwater Monitoring Data, Chemical Waste Management, Model City Facility, dated April 1985 by Golder Associates
3. Groundwater Monitoring Plan, Chemical Waste Management, Inc., Model City, New York Facility, dated May 1985 by Golder Associates

* Under State law, the permit remains in effect after expiration until a new one is issued. The permit expired in May 1984 and is being revised by DEC.

The information presented in these documents is required by RCRA regulations [Part 270.14(c)(1) through (6)] for a Part B application and the State for reissuance of the General Operating Permit.

The documents listed above proposed a new ground-water monitoring program, including a completely new well network. This program was the principal subject of the ongoing meetings between DEC, EPA, CWM personnel and their consultant, Golder Associates, just before the Task Force inspection.

Although final plans had not been made before the end of the Task Force inspection, there was agreement between the parties on locations and depths for most of the proposed wells (about 70 new wells will be installed). A principal area of disagreement, involving the spacing between wells, was resolved just before the Task Force inspection. Because the issue relates to many other sites which the Task Force is evaluating, the resolution procedures will be briefly discussed.

The Company's consultant used recently acquired and historical hydro-geologic data for the site to develop computer simulations of several types of possible leaks to evaluate potential pathways, rates of travel and projected plumes for different periods after the leak started. Government modeling experts, consulted about the model used, recommended further sensitivity analyses be conducted before it could be endorsed as a useful tool. These were done to the Government's satisfaction along with plume projections for additional time intervals.

Initially, the consultant based well spacings on projected plume widths at the edge of a waste unit 120 years after a leak started. Government personnel opted for a 40-year period based on a 10-year operational life for the regulated unit followed by a 30-year post-closure monitoring period. The computer projections were based on many conservative assumptions about the site, some of which diverge from reality over time (e.g., assuming steady-state conditions during the long periods modeled). Consequently, the computed distances were used as a starting point for determining well spacings.

Final well spacings were determined after considering several factors including actual time each unit had been in service, types of liners present, results of ground-water monitoring to date and natural variations in site hydrogeology which were not accounted for by the model. Also, allowance was given for internal dikes in a landfill where those dikes intersected the perimeter dike on the downgradient side (spacing was calculated on the basis of the width of each cell's floor).

Major unresolved issues addressed during the fall of 1985 included:

1. Whether the groundwater beneath the site has been contaminated by site operations, thereby requiring a compliance monitoring program instead of the program SCA has proposed for detection monitoring
2. Whether certain regulated units (tank 58 and the facultative ponds) are subject to the RCRA ground-water monitoring requirements
3. Whether any filtering of sample aliquots will be allowed
4. Which indicator parameters or hazardous waste constituents will be selected for monitoring
5. Which analytical methods will be used for measuring detection monitoring indicator parameters
6. What statistical procedure will be used to evaluate the impact of the regulated units on the ground water

MONITORING DATA ANALYSIS FOR INDICATIONS OF WASTE RELEASE

This section presents an analysis of both Task Force and SCA monitoring data regarding indications of apparent or potential leakage from the waste management units. Analytical results from and methods used on samples collected by Task Force personnel are presented in Appendix F.

Task Force data indicate the presence of organic hazardous waste constituents in three Zone 1 wells [Table 22]. The compounds are identified as waste constituents because they are present in leachate in landfills either near the wells or at the facility. The waste constituents detected in well Z-3 have been previously detected and confirmed by SCA. Both Task Force and SCA data indicate these compounds are present in leachate in SLF 7 [Appendix F, Tables F-9 and -10], which is adjacent to Z-3.

Table 22
HAZARDOUS WASTE CONSTITUENTS
DETECTED IN SAMPLES FROM MONITORING WELLS^a

Compound	Well Z-3	Well Z-11	Well Z-13
1,1-Dichloroethylene	7. ^b	< 7. ^c	< 7.
Trans-1,2-dichloroethylene	320. ^d	< 7.	< 7.
Trichloroethylene	130. ^d	< 6.	< 6.
α -BHC	< 0.1	0.29 ^b	0.23 ^b
β -BHC	< 0.1	0.21 ^b	0.40 ^b
γ -BHC (lindane)	< 0.1	0.18 ^b	0.15 ^b
Aroclor 1242 (PCB)	< 0.5	< 0.3	0.6 ^d

^a Concentrations in $\mu\text{g}/\ell$

^b Control measures indicate value is within 50% to 150% of actual concentration at 95% confidence

^c < X denotes sample concentration is less than X at 99% confidence

^d Control measures indicate value is within 75% to 125% of actual concentration at 95% confidence

The BHC isomers found in wells Z-13 and PCB in well Z-11 have not been previously detected in those wells; however, the concentrations are very low (less than one microgram per liter - $\mu\text{g}/\ell$). The low concentrations are well below the detection limits used by the SCA contractor laboratory.

Task Force data show that these compounds are also present in leachate samples collected from SLF 4, which indicates the facility has received wastes containing these compounds. PCBs have been detected by SCA in the west salts area, which is adjacent to Z-13.

SCA and Task Force data indicate elevated TOX concentrations (i.e., greater than 100 µg/l)* in seven Zone 1 wells [Table 23]. These elevated TOX concentrations indicate the presence of halogenated (containing chlorine, bromine or iodine) organic compounds.^{1 2} Their presence is significant because most halogenated organics are suspect of being toxic or carcinogenic and they rarely occur in nature.³ The compounds composing the measured TOX were not identified, except for well Z-3, by the standard methods used on Task Force samples, nor have they been identified by SCA, whose methods are essentially the same. High concentrations of many halogenated organic compounds are present in the leachate [Appendix F, Tables F 9 and 10]. The TOX "indicator" test can detect these compounds at low levels, where the analytical methods used to identify compounds in the leachate and well samples may not be sensitive to them.^{2 3 4 5} Special or research-type methods may be required to identify the compounds.

Of the wells where elevated TOX concentrations are indicated, Z-3 is adjacent to SLF 7 and known to contain hazardous waste constituents. Leachate levels, base elevation and water table elevations at SLF 7 (see page 40 and Table 15) indicate periods of outward hydraulic gradient which

* The TOX value of 100 µg/l, used as a benchmark for identifying elevated concentrations, was based on the referenced literature, two data sets and professional judgment. The first data set included SCA quarterly monitoring data collected between March and November 1984 and contains 81 TOX values. Seventy of these are less than 100 µg/l; 11 are greater. For the 70 measurements, the concentrations range from 10.2 to 95 µg/l and average 58.4 µg/l. For the 11 measurements greater than 100 µg/l, concentrations range from 100 to 797 µg/l and average 271 µg/l. The 11 values are from 7 wells, all of which are in Zone 1. Secondly, literature reviewed contained data for samples collected from 22 water supply wells in the United States. Concentrations ranged from less than 5 to 85 µg/l, with an average of 18 µg/l.² The value of 100 µg/l is, therefore, considered to be conservative benchmark concentration.

would promote leakage from the landfill. Well Z-6 is near the Olin Burn Area and may be reflecting pre-RCRA releases at the site.

Table 23
TOX CONCENTRATIONS IN SELECTED WELLS
(concentrations in µg/l)

Well	First Quarter ^a 3-5/84	Second Quarter 6-8/84	Third Quarter 9-11/84	6/85 ^b	Task Force
Z-3	- ^c	215	331	220	278
Z-6	-	-	100	-	-
Z-8	342	-	148	130	-
Z-10	408	-	797	365	-
Z-11	-	134	-	96	96
Z-12	186	-	216	210	-
Z-19	-	84.4	105	73	67

- a Quarterly monitoring data from April 1985 report by Golder Associates titled "Evaluation of Groundwater Monitoring Data, Chemical Waste Management, Model City Facility".
- b The June 1985 data are from a September 24, 1985 letter report to Mr. Richard M. Walka of EPA Region II from Mr. Johan Bayer of CWM regarding "Final Groundwater Assessment Report: SCA Chemical Services Model City, New York".
- c Dash (-) indicates no data reported

Well Z-8 is about 75 feet west of lagoon 6 and salts area 7, both of which contained liquid hazardous waste and had outward hydraulic gradients, as discussed in the section on Waste Management Units. The location is also hydraulically downgradient from the old west drum storage area where spills have been reported.

Well 10 is adjacent to (or in) the pre-RCRA Town of Lewiston salts area, which was used to store sludge from the aqueous waste treatment system. Wells Z-11 and Z-12 are both adjacent to Facultative Pond 3 and across the street from SLF 10, which are potential sources of the organic halogen compounds.

Well Z-19 is at the northwest corner SLF 11a. Elevated TOX concentrations were noted before waste disposal began in that landfill. Potential

sources of the organic halogens include the Olin Burn Area, the old north durm storage area and SLF 7.

Additional work is necessary by SCA to identify the specific halogenated organic compounds being detected by the TOX analyses and their sources. Once these compounds are identified, samples from the other wells should be analyzed for them as TOX concentrations of less than 100 µg/l in current SCA data may represent analytical error, the presence of halogenated organic compounds or both.

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APPENDICES

- A SOLID/HAZARDOUS WASTE PERMITS ISSUED FOR MODEL CITY FACILITY
- B PCB DISPOSAL APPROVALS ISSUED BY U.S. EPA, REGION II
- C AGREEMENTS AND STATE ORDERS RELATING TO SOLID WASTE MANAGEMENT
- D LETTER FROM DEC TO EPA ON DEFICIENCIES IN PART B PERMIT APPLICATION
- E NEW YORK POLICY ON ALTERING SAMPLES TO BE ANALYZED FOR ORGANIC COMPOUNDS
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APPENDIX A

SOLID/HAZARDOUS WASTE PERMITS ISSUED FOR MODEL CITY FACILITY

SOLID/HAZARDOUS WASTE PERMITS
ISSUED FOR MODEL CITY FACILITY

Permit Number	Issue Date	Expiration Date	Type	Issued To	Issuer
-	11/08/71	-	Approval to operate dumping areas 1 2 and 3 and lagoons	Chem-Trol	Niagara County Health Dept.
-	09/06/73	-	Approval to construct SLF 3	Chem-Trol	Niagara County Health Dept.
-	03/06/74	-	Approval to construct SLF 4	Chem-Trol	DEC
-	11/01/74	-	Approval to construct SLF 4	Chem-Trol	DEC
-	07/30/76	-	Approval to construct SLF 5	Chem-Trol	DEC
-	05/13/77	-	Approval to construct SLF 6	Chem-Trol	DEC
2218	05/03/78	05/01/75	Approval to construct SLF 2	Newco Chemical Waste System, Inc.	DEC
2211	06/28/78	07/01/79	Approval to construct SLF 7	Chem-Trol	DEC
2228	09/07/78	07/01/80	Approval to operate SLF 7	SCA Chem-Trol	DEC
2052	02/25/80	01/01/81	Modification to operate SLF 7	SCA	DEC
2343	05/01/81	05/01/84	Approval to operate general facility	SCA	DEC
2342	05/01/81	05/01/84	Approval for expansion of SLF 7	SCA	DEC
-	05/20/81	-	Amendment to Permit 2052	SCA	DEC
2558	07/09/81	-	Approval to operate expansion of SLF 7	SCA	DEC
2593	10/28/81	10/21/86	Approval to construct SLF 10	SCA	DEC
2728	08/09/82	05/01/84	Approval to operate SLF 10	SCA	DEC
-	08/08/83	-	Modification to Permit 2343	SCA	DEC
3423	-	-	Approval to construct SLF 11	SCA	DEC
3427	05/26/84	07/01/88	Approval to construct and operate SLF 11a	SCA	DEC
-	06/10/84	-	Amendment to Permit 2343 and 2728	SCA	DEC

APPENDIX B

PCB DISPOSAL APPROVALS ISSUED BY U.S. EPA, REGION II

PCB DISPOSAL APPROVALS ISSUED BY U.S. EPA, REGION II

Issue Date	Expiration Date	Facility Unit	Comments
October 2, 1978	October 2, 1981	SLF 7	Operation of unit
February 6, 1980		SLF 7	Modification of unit
June 19, 1981		SLF 7	Expansion of unit
December 8, 1981		SLF 7	Leachate collection approval
April 27, 1982	April 27, 1985	SLF 10	Operation of unit
June 4, 1982		SLF 10	Leachate collection approval
January 28, 1985		SLF 11a	Operation of unit

APPENDIX C

AGREEMENTS AND STATE ORDERS RELATING
TO SOLID WASTE MANAGEMENT

Appendix C
 AGREEMENTS AND STATE ORDERS FOR
 SCA MODEL CITY FACILITY

Date	File No.	Comments
<u>Wastewater Management</u>		
August 5, 1974	73-94	Cleanup of Four Mile Creek, submittal of SPCC Plan, penalty payment
February 28, 1977	76-35	Cleanup of releases, penalty payment, notify DEC of releases
January 9, 1978	76-35A	Penalty payment, failure to comply with 76-35
April 25, 1978	76-35B	Penalty payment, failure to comply with 76-35
July 6, 1978	76-35C	Penalty payment, failure to comply with 76-35
November 13, 1978	0-0291	Upgrade of treatment system and other remedial actions, operation requirements
October 22, 1979*		Modification to above
November 6, 1980	80-86	Modification to File No. 0-0291
January 9, 1981		Suspension of operation of Facultative Pond 8, notice of intent to suspend permit, reopening of NPDES permit hearing
March 31, 1982**		Modification of effluent limits, study to upgrade treatment system, modified monitoring requirements
May 24, 1983*	80-76	Modification to File No. 0-0291

* Date the order was consented to by SCA

** Agreement between SCA, DEC, towns of Porter and Lewiston and citizen group

Appendix C (cont.)

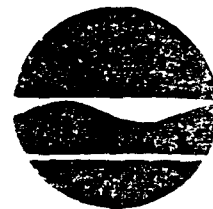
Date	File No.	Comments
<u>Solid Waste Management</u>		
January 16, 1979*	76-350	Penalty payment, remedial action outlined
October 17, 1979	79-47	Penalty payment for the complaint due to leachate pumping
March 6, 1980		Penalty payment for odor complaints
January 8, 1981	80-79	Penalty payment, exceeded leachate level SLF 7
April 20, 1982	82-48	Penalty payment for discharge of liquid and odors
May 19, 1982	82-61	Penalty payment for odor complaint
June 28, 1982	82-87	Penalty payment for odor complaint
January 21, 1983	82-207	Same as above and failure to maintain freeboard and remedial actions outlined
June 15, 1983*	83-64	Failed to meet compliance dates in Permit 2343, schedule outlined
December 19, 1983*		Agreement with Ontario Ministry of Environment regarding ground-water monitoring system and testing
December 13, 1983*		Agreement with Citizen Intervenors regarding ground-water monitoring and testing, site operation and site studies
February 2, 1984		Agreement with Citizen Intervenors regarding site operation, construction and studies
December 18, 1984	84-140	Penalty payment for manifest discrepancies, remedial actions outlined

* Contains requirements relating to ground-water monitoring

APPENDIX D

LETTER FROM DEC TO EPA ON DEFICIENCIES
IN PART B PERMIT APPLICATION

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-0001



Henry G. Williams
Commissioner

OCT 30 1984

Mr. James M. Reidy, P.E.
Chief
New York Hazardous Waste Section
U.S. Environmental Protection Agency
Region II
26 Federal Plaza
New York, NY 10278

Dear Mr. Reidy:

Re: Part 8 Application
Notice of Deficiency (Partial)
SCA Chemical Services
Model City, New York
EPA I.D. No. NY0049836674

Volume 12 of the above referenced Part 8 Application has been reviewed by my staff and has been found to be grossly deficient. That volume deals with the groundwater protection requirements which are set forth in 40 CFR Part 264, Subpart F.

Deficiencies in this application are extensive and major revisions of the application will be necessary.

It should be noted that DEC staff met with the application on November 18, 1983 to informally discuss the groundwater monitoring program at the facility. At that time, the applicant was advised that there were major deficiencies in the Part 8 application; specifically in the proposed groundwater monitoring network. On October 15, 1984 the Department received a copy of a draft report "Evaluation of Hydrogeologic and Monitoring Data, Model City, NY Site." That report was prepared for SCA by Geoenvironment Incorporated. The report was ostensibly submitted to respond to the concerns which the Department had expressed during the November 1983 meeting, but does little to enhance the adequacy of the Permit Application.

D-2

Mr. James M. Reidy, P.E.
page 2

OCT 30 1984

It should also be noted that subsequent to the submission of the Part B Application, SCA has modified its groundwater sample collection procedures. During the past year the company has replaced all of its former gas-lift monitoring wells with wells that use "Geomon" sampling devices. They did so with the acceptance of the NYSDEC, but they have not, as of yet, submitted to the Department the information necessary to evaluate the adequacy of the sampling device. Said information was requested in January 1984 and again in September 1984. Furthermore, after seeing the sampling device in operation during a September 1984 inspection of the facility, DEC staff have misgivings about the device's potential impacts upon the integrity of groundwater samples.

Sincerely,



Paul R. Counterman, P.E.
Chief
Bureau of Hazardous Waste Technology
Division of Solid and Hazardous Waste

Enclosure

cc: w/enc. - J. Rotola
W. Pedicino

APPENDIX E

NEW YORK POLICY ON ALTERING SAMPLES TO
BE ANALYZED FOR ORGANIC COMPOUNDS

MEMORANDUM FOR
HENRY G. WILLIAMS, Comm

New York State
Department of Environmental Conservation

MAY 3 1985

TO: Executive Staff, Division Directors, and Regional Directors
FROM: Hank Williams *Hank Williams*
RE: Policy on Altering* Water Samples to be Analyzed for Organic Compound

The altering of groundwater samples from wells involved in the assessment, investigation, remedy, study, construction, monitoring and other activities at sites throughout the State has been requested of the Department of Environmental Conservation by some parties responsible for sites who have opted to perform work through their own consultants and at their own expense.

The Department's denial on this point has been consistent, since we expect that data from altered samples will significantly diminish actual concentrations of organic compounds. Moreover, the United States Environmental Protection Agency has forbidden filtration of samples in which volatile constituents are of interest, since filtration may strip these constituents from the sample. This directive can be found in Proposed Sampling and Analytical Methodologies for Addition to Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. SW-846, Second Edition, USEPA, Washington, D.C. 1984.

The Department has denied any request that filtering and centrifuging of samples be an acceptable technique; on the other hand, some responsible parties persistently present arguments in support of the demand. There are a few cases where negotiations have reached an impasse, the resolution of which may be difficult to reach.

This policy will serve a four-fold purpose:

- 1) The Department's policy will have been stated officially in writing.
- 2) The stated policy will provide added impetus to the Department's present efforts at denying filtration and centrifugation of samples.
- 3) A responsible party(ies) will be discouraged from proposing or attempting filtration or centrifugation of samples.

* "Altering" includes filtering, centrifuging, decanting or any other treatment or manipulation by which a sample may be disturbed.

Executive Staff, Division Directors,
and Regional Directors

2.

- 4) Negotiations between the Department and responsible parties on this issue will be abbreviated, and the required activities at a site under consideration will begin without undue loss of time.

The policy of the New York State Department of Environmental Conservation regarding altering of samples applies to groundwater samples as well as any other types of water samples over which the Department exercises its regulatory powers. Effective immediately, the Department's policy on the altering of water samples to be analyzed for organic compounds is as follows: Water samples utilized in the assessment, investigation, remedy, study, construction, monitoring or any other activity shall not be altered prior to analysis.

APPENDIX F

ANALYTICAL TECHNIQUES AND RESULTS FOR
TASK FORCE SAMPLES, SCA, MODEL CITY

ANALYTICAL TECHNIQUES AND RESULTS FOR TASK FORCE SAMPLES, SCA, MODEL CITY

The following discusses analytical techniques, methods and results for the ground-water and leachate samples collected by the Ground Water Task Force at SCA, Model City. Ground-water sample analyses and results are discussed in the first section; the second section addresses the leachate analyses and results.

GROUND-WATER SAMPLE ANALYSIS RESULTS

Field measurements on ground-water samples, including conductance, pH and turbidity, were made by the EPA sampling contractor at the time of sampling. Laboratory analysis results were obtained from two EPA contractor laboratories (CL) participating in the Contract Laboratory Program (CLP). One CL analyzed the samples for specified organic compounds while the other analyzed for metals and other parameters.

Standard quality control measures were taken including: (1) the analysis of field and laboratory blanks to allow determination of possible contamination due to sample handling, (2) analysis of laboratory spiked samples and performance evaluation samples to estimate accuracy, (3) analysis of laboratory duplicates and field triplicates to estimate precision, and (4) the review and interpretation of the results of these control measures. The performance evaluation samples were samples of known analyte concentrations prepared by the EPA Environmental Monitoring Systems Laboratory, Cincinnati, Ohio. Samples from two wells analyzed by the CL were split with the NEIC. Organic extracts, prepared by the CL of samples from wells Z-11 and Z-13, were also analyzed by NEIC to confirm the CL analysis results for pesticides and PCBs.

Table F-1 provides a summary, by parameter, of the analytical techniques used and the reference method for ground-water sample analyses.

Analysis Results

Specific Organic Analysis Results

Table F-2 lists the organic compounds which can be reported with certainty as being present in the ground-water samples for the identified wells. The results in Table F-2 are based on the CL analyses plus NEIC confirmation of the pesticide results and NEIC PCB analysis results for the samples for Wells Z-11 and Z-13. The identities of the BHC isomers reported in Table F-2 were confirmed by analysis of the CL base/neutral extract at the NEIC. The CL analysis results for the BHC isomers are reported. The Aroclor 1242 identification and the amount reported is also based on NEIC analysis of the base/neutral fraction CL extract after a sulfuric acid cleanup. The pesticide fraction extract was not available from the CL. NEIC analyses were performed about 6 months after extraction. The accuracy of each detectable value, relative to the extract analysis, is footnoted in the table.

Table F-3 contains the limits of quantitation for the analyses for volatiles, semi-volatiles and pesticides. Based on matrix spike recoveries, these limits, relative to the sample, can be considered reliable to within a few parts per billion for the volatiles and to within factors of two to twenty for the semi-volatiles and pesticides. These limits apply to all parameters except for the acid fraction compounds in the samples for Wells Z-4, Z-9, Z-13, Z-19 and Z-21. The acid fraction compounds for these five samples should be considered "not analyzed" because of very low or non-existent acid surrogate recoveries.

The compounds listed in Table F-3 were not detected above blank levels in samples other than those found in samples for Wells Z-3, Z-11 and Z-13.

Metals Analysis Results

The dissolved and total metals results for the SCA Zone 1 and Zone 3 well samples are reported in Tables F-4 and F-5, respectively. The accuracy of each detectable value is footnoted in the tables.

Samples for four wells were found to contain notable heavy metal concentrations. The total metals analyses for the samples from Wells B-21A, B-84A and B-116 found detectable levels of arsenic, beryllium, chromium, cobalt, copper and nickel. The sample for Well B-21A contained the highest concentrations with arsenic at 87 $\mu\text{g}/\text{l}$, beryllium at 6 $\mu\text{g}/\text{l}$, chromium at 181 $\mu\text{g}/\text{l}$, cobalt at 113 $\mu\text{g}/\text{l}$, copper at 97 $\mu\text{g}/\text{l}$ and nickel at 217 $\mu\text{g}/\text{l}$. In all three wells, the heavy metals appear to be associated with carbonate or iron particulates as calcium, magnesium and iron concentrations were much greater for the total metals analyses over the dissolved metals analyses. Further, the heavy metals concentrations of the dissolved samples for these wells were near or below detection limits. Nickel was detected at a concentration of 30 $\mu\text{g}/\text{l}$ in both the total and dissolved analyses for the samples for Well Z-19.

No total values are reported for manganese, potassium, silver and thallium because the lower 99% confidence limits for the spike recoveries for these elements were below zero. Zinc values are not reported because of contamination due to sample handling. For example, a dissolved zinc concentration of 412 $\mu\text{g}/\text{l}$ was found for the sample for Well Z-11, while the total zinc concentration was only 8 $\mu\text{g}/\text{l}$.

Total cadmium and lead results for the samples for Wells B-21A and B-84A are not reported because of severe aluminum and iron interference on the spectral lines. Similarly, spectral background interference prevented the analysis of selenium for the Well Z-4 sample and resulted in rather high detection limits for selenium for Wells B-21A, B-22B, B-35A, B-84A and B-116 and for thallium for Well B-35A.

One of the three spike recoveries for total barium was 62% at a spike level of 4,000 $\mu\text{g}/\text{l}$. However, a recovery of 96% was obtained for a spike level of 2,000 $\mu\text{g}/\text{l}$ to the same sample for the dissolved barium analyses. Barium's solubility generally decreases with increasing sulfate concentration. The spiked sample contained about 1,400 $\mu\text{g}/\text{l}$ sulfate. The difference in the spike recoveries, indicates that total barium spike level exceeded the solubility limit while the dissolved barium spike level did not. Since none barium concentrations in the ground-water samples exceeded 1,000 $\mu\text{g}/\text{l}$, the low spike recovery is not considered representative of the accuracy achieved for the analysis.

General Analysis Results

The field measurements for conductance, pH and turbidity and the results of other analytical testing for Zone 1 and Zone 3 well samples are reported in Tables F-6 and F-7, respectively. The reliability of detectable values are footnoted.

The cyanide data are highly suspect. Initial analysis of the sample for Well Z-11 in duplicate found cyanide concentrations of about 10 $\mu\text{g}/\text{l}$ and 30 $\mu\text{g}/\text{l}$. Reanalysis of the sample in duplicate a week later found the cyanide to be nondetectable (less than 6 $\mu\text{g}/\text{l}$). Glassware contamination or the instability of cyanide could possibly explain this occurrence. The cause of this occurrence could not be identified.

LEACHATE SAMPLE ANALYSIS RESULTS

No field measurements were made for the leachate samples. All leachate analyses were performed by NEIC which included most of the standard quality measures mentioned above.

The samples received for Sumps 8, 10 and 28 varied widely as to the amounts of the nonaqueous and aqueous phases in different sample bottles (see Investigation Methods section of this report). The nonaqueous liquid

phase of the different sample bottles ranged on a volume basis from 0% to 35% for Sump 8, from 0% to 70% for Sump 10 and from 0% to 90% for Sump 28.

Table F-8 provides a summary, by parameter, of the analytical techniques used and the reference methods for the leachate sample analyses.

Analysis Results

Specific Organic Analysis Results

Tables F-9 and F-10, respectively, list volatile organic compounds and semi-volatile organic compounds that were detected in the leachate samples. The leachates contained a variety of compounds in significant concentrations including PCBs, chlorinated benzenes, phenols, aniline and chlorinated and non-chlorinated solvents.

The semi-volatile organic samples for Sump 10 and 28 contained both nonaqueous and aqueous phases. However, the volatile organics sample bottles for these sumps contained only aqueous phases. For the semi-volatile organic analyses, the nonaqueous and aqueous phases were each analyzed. Nonaqueous phase concentrations are reported in $\mu\text{g}/\text{kg}$ units while the aqueous phase concentrations are reported in $\mu\text{g}/\text{l}$ units. The nonaqueous phase Sump 10 sample was high enough in halogenated organics that the density was 1.24 g/ml . This phase was found to contain 6.6% PCB. The identification of Aroclor 1242 in five leachate samples, as opposed to the very similar Aroclor 1016, cannot be absolutely certain due to the presence of interfering species.

The base/neutral extract for the Sump 10 sample was analyzed by capillary column gas chromatography with electron capture detection in order to quantitate the BHC isomer identified in the mass spectroscopy analysis. No other leachate samples were analyzed for the BHC isomers or other pesticides.

All organic analyses results should be considered semi-quantitative (i.e., concentrations are probably reliable to within 10% to 200% of actual sample concentrations for the semi-volatiles and 50% to 150% for the volatiles). Table F-11 lists the limits of quantitation for compounds determined. Many compounds given in Table F-11 were not detected in any of the samples and thus are not listed in Tables F-9 and F-10.

Metals Analysis Results

The metals results for the leachate samples are reported in Table F-12. High concentrations of heavy metals were found in many of the samples. These metals included antimony, arsenic, cadmium, chromium, nickel, selenium and zinc.

Depending on the suspended matter composition, the values reported for certain elements may not represent "total" concentrations. If the suspended matter is siliceous then values for aluminum, magnesium, potassium, sodium and titanium are not "total" because the silicate matrix was not dissolved. The heavy metal results would approximate "total" concentrations because they are usually absorbed and are not incorporated in the silicate matrix.

The accuracy of each detectable value is footnoted in the table. The accuracy is only that indicated by spike recoveries, variability between sample containers has not been evaluated.

The two phases for the Sumps 8, 10 and 28 samples were analyzed as composites. The compositing was based on an estimate of the volume of each phase.

General Analysis Results

Table F-13 reports the results of other testing. Sumps 8 and 10 were only analyzed for water content. For the Sump 28 sample only the aqueous phase was analyzed.

High concentrations of chloride, sulfate and ammonia were found in a number of the leachate samples. The bromide levels are high relative to the chloride levels. Bromide to chloride ratios of about 1:300 are common in natural waters.

Rather high Gross Alpha and Gross Beta activity were found for some of the leachates.

GROUND-WATER SAMPLE ANALYSIS TECHNIQUES AND METHODS

Parameter	Analytical Technique	Method Reference
Conductance	Electrometric	No reference
pH	Potentiometry	No reference
Turbidity	Neophelometric	No reference
POX	Combustion of purgable fraction, Microcoulometry Detection	EPA 600/4-84-008
TOX	Carbon absorption, combustion, Microcoulometry Detection	Method 9020 (a)
POC	Combustion of purgable fraction, Non-dispersive Infrared Detection	No reference
NPOC	Acidify, Purge, Combustion of liquid, Non-dispersive Infrared Detection	Method 415.1 (b)
Chloride	Mercuric Precipitation Titration	Method 9252 (a)
Nitrate	Brucine Sulfate Colorimetry	Method 9200 (a)
Sulfate	Barium Sulfate Turbidimetry	Method 9038 (a)
Ammonia	Phenolate Colorimetry	Method 350.1 (b)
Cyanide	Distillation, Colorimetry	CLP Method (c)
Phenol	Distillation, Colorimetry	Method 420.1 (a)
Dissolved and Total Hg	Wet digestion for dissolved and total, Cold Vapor AAS	CLP Method
Dissolved As, Pb, Se and Tl	Furnace AAS	CLP Method
Total As, Se and Tl	Acid digestion, Furnace AAS	CLP Method
Total Pb	Acid digestion, Furnace AAS	CLP Method
	Acid digestion, ICAP-OES For three well samples	CLP Method
Volatiles	Purge and trap GC-MS	CLP Method
Semi-volatiles	Methylene Chloride extraction, GC-MS	CLP Method
Pesticides	Hexane extraction, GC-EC	CLP Method
PCBs	Methylene chloride extraction, sulfuric acid cleanup, GC-EC	CLP BNA Extract Method 608 (d)
=====	=====	=====

a - Test Methods for Evaluating Solid Wastes, SW-846.

b - Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020.

Table F-2

DETECTABLE SPECIFIC ORGANIC ANALYSIS RESULTS
FOR THE GROUNDWATER SAMPLES
SCA MODEL CITY FACILITY

Compound (a)	Well Z-3	Well Z-11	Well Z-13
1,1-Dichloroethene	7. d	< 7. b	< 7.
trans-1,2-Dichloroethene	320. c	< 7.	< 7.
Trichloroethene	130. c	< 6.	< 6.
alpha-BHC	< 0.1	0.29 d	0.23 d
beta-BHC	< 0.1	0.21 d	0.40 d
gamma-BHC	< 0.1	0.18 d	0.15 d
Aroclor 1242	< 0.5	< 0.3	0.6 c

a - Concentrations in ug/L

b - < X denotes sample concentration is less than X at 99% confidence.

c - Control measures indicate value is within 75% to 125% of actual concentration at 95% confidence.

d - Control measures indicate value is within 50% to 150% of actual concentration at 95% confidence.

CONTRACT LABORATORY LIMITS OF QUANTITATION FOR ORGANIC
COMPOUNDS IN SCA GROUND-WATER SAMPLES

Limit of Quantitation (µg/l)		Limit of Quantitation (µg/l)		Limit of Quantitation (µg/l)	
<u>Base/Neutral Compounds</u>		<u>Acid Compounds</u>		<u>Pesticides/PCBs</u>	
Acenaphthene	10	2,4,6-Trichlorophenol	10	Aldrin	0.05
1,2,4-trichlorobenzene	10	Parachlorometacresol	20	alpha-BHC	0.05
Hexachlorobenzene	10	2-Chlorophenol	10	beta-BHC	0.05
Hexachloroethane	10	2,4-Dichlorophenol	10	gamma-BHC	0.05
bis(2-Chloroethyl) ether	10	2,4-Dimethylphenol	10	delta-BHC	0.05
2-Chloronaphthalene	10	2-Nitrophenol	10	Chlordane	0.5
1,2-Dichlorobenzene	10	4-Nitrophenol	50	4,4'-DDD	0.1
1,3-Dichlorobenzene	10	2,4-Dinitrophenol	50	4,4'-DDE	0.1
1,4-Dichlorobenzene	10	4,6-Dinitro-o-cresol	50	4,4'-DDT	0.1
2,4-Dinitrotoluene	10	Pentachlorophenol	50	Dieldrin	0.1
2,6-Dinitrotoluene	10	Phenol	10	Endosulfan I	0.05
1,2-Diphenylhydrazine ^a	NA [*]	Benzoic acid	50	Endosulfan II	0.1
Fluoranthene	10	4-Methylphenol (p-cresol)	10	Endosulfan sulfate	0.1
4-Chlorophenyl phenyl ether	10	2-Methylphenol (o-cresol)	10	Endrin	0.1
4-Bromophenyl phenyl ether	10	2,4,5-Trichlorophenol	50	Endrin aldehyde	0.1
bis(2-Chloroisopropyl) ether	10			Heptachlor	0.05
bis(2-Chloroethoxy) methane	10			Heptachlor epoxide	0.05
Hexachlorobutadiene	10	<u>Volatile Compounds</u>		Toxaphene	1
Hexachlorocyclopentadiene	20	Benzene	5	Methoxychlor	0.5
Isophorone	10	Bromodichloromethane	5	Endrin ketone	0.1
Naphthalene	10	Baroform	5	PCB-1016	0.5
Nitrobenzene	10	Bromomethane	10	PCB-1221	1
N-nitrosodimethylamine ^b	NA	Carbon Tetrachloride	5	PCB-1232	1
N-nitrosodiphenylamine ^b	40	Chlorobenzene	5	PCB-1242	0.5
N-nitrosodi-n-propylamine	10	Chloroethane	10	PCB-1248	0.5
Bis(2-Ethylhexyl) phthalate	10	Chloroform	5	PCB-1254	1
Butylbenzylphthalate	10	Chloromethane	10	PCB-1260	1
Di-n-butylphthalate	10	Dibromochloromethane	5		
Di-n-octylphthalate	10	1,1-Dichloroethane	5		
Diethylphthalate	10	1,2-Dichloroethane	5		
Dimethylphthalate	10	1,1-Dichloroethene	5		
Benzo(a)anthracene	10	trans-1,2-Dichloroethene	5		
Benzo(a)pyrene	10	1,2-Dichloropropane	5		
Benzo(b)fluoranthene and/or		Ethylbenzene	5		
Benzo(k)fluoranthene	10	Methylene chloride	5		
Chrysene	10	1,1,2,2-Tetrachloroethane	5		
Acenaphthylene	10	Tetrachloroethene	5		
Anthracene	10	Toluene	5		
Benzo(g,h,i)perylene	10	1,1,1-Trichloroethane	5		
Fluorene	10	1,1,2-Trichloroethane	5		
Phenanthrene	10	Trichloroethene	5		
Dibenzo(a, h)anthracene	10	Vinyl chloride	10		
Indeno(1,2,3-c,d)pyrene	10	Acetone	100		
Pyrene	10	2-Butanone (MEK)	20		
Benzdine	NA	1,2-Dibromoethane (EDB)	20		
3,3'-Dichlorobenzidine	100	2-Hexanone	20		
Aniline	10	Xylenes	5		
Benzyl chloride	10	1,4-Dioxane	1000		
Benzyl alcohol	20	1,2-Dibromo-2-chloropropane	100		
p-Chloroaniline	100	Pyridine	100		
Oibenzofuran	10	Acrolein	1000		
2-Methylnaphthalene	10	Acrylonitrile	500		
4-Nitroaniline	100	Carbon disulfide	5		
Pentachlorobenzene	10	trans-1,3-Dichloropropene	5		
1,2,4,5-Tetrachlorobenzene	10	cis-1,3-Dichloropropene	5		
1,2,3,4-Tetrachlorobenzene	10	2-Chloroethylvinylether	40		
Pentachloronitrobenzene	10	Styrene	5		
2-Methylnaphthalene	10	Vinyl acetate	40		
2-Nitroaniline	100	4-Methyl-2-pentanone	20		
3-Nitroaniline	100				

^a Measured as Azobenzene

^b Measured as diphenylamine

^{*} Not Analyzed

Table F-4

DISSOLVED AND TOTAL METAL ANALYSIS RESULTS
FOR THE ZONE 1 WELLS
SCA MODEL CITY FACILITY

Element(a)	Well Z-3		Well Z-4		Well Z-5		Well Z-9	
	Dissolved Value	Total Value	Dissolved Value	Total Value	Dissolved Value	Total Value	Dissolved Value	Total Value
Al	< 66. b	218. d	< 66.	< 120.	< 66.	< 120.	< 66.	< 120.
Sn	< 170.	< 170.	< 170.	< 170.	< 170.	< 170.	< 170.	< 170.
As	< 8.	< 9.	< 7.	< 12.	< 8.	< 10.	< 9.	< 12.
Ca	87. c	88. c	78. c	81. c	< 33.	< 66.	83. c	87. c
Br	< 0.9	< 1.7	< 0.9	< 1.7	< 0.9	< 1.7	< 0.9	< 1.7
Cl	< 9.	< 18.	< 9.	< 18.	< 9.	< 18.	< 9.	< 18.
Cr	114,000. e	120,000. e	95,000. e	95,900. e	166,000. e	165,000. e	90,100. e	93,100. e
Cr	< 10.	< 18.	< 10.	< 18.	< 10.	< 18.	< 10.	< 18.
Co	< 11.	< 22.	< 11.	< 22.	< 11.	< 22.	< 11.	< 22.
Cu	< 8.	< 16.	< 8.	< 16.	< 8.	< 16.	< 8.	< 16.
Fe	109. d	563. e	629. d	2,860. e	829. d	1,700. e	< 43.	392. e
Pb	< 13.	< 32.	< 14.	< 52.	< 13.	< 34.	< 18.	< 26.
Mg	55,800. e	57,400. e	66,300. e	65,900. e	55,200. e	54,600. e	196,000. e	197,000. e
Mn	812. e	f	1,510. e	f	285. e	f	860. e	f
Hg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ni	< 15.	< 18.	< 15.	< 18.	< 15.	< 18.	< 15.	< 18.
K	2,300. e	f	3,110. e	f	3,440. e	f	2,630. e	f
Se	< 10.	< 19.	< 13.	f	< 12.	< 20.	< 22.	< 12.
Ag	< 12.	f	< 12.	f	< 12.	f	< 12.	f
Na	111,000. e	108,000. d	40,800. e	39,100. d	132,000. e	127,000. d	117,000. e	118,000. d
Li	< 7.	f	< 12.	f	< 12.	f	< 18.	f
Sn	< 97.	< 150.	< 97.	< 150.	< 97.	< 150.	< 97.	< 150.
V	< 10.	< 12.	< 10.	< 12.	< 10.	< 12.	< 10.	< 12.

a - Concentrations in ug/L

b - < X denotes sample concentration is less than X at 99% confidence.

c - Control measures indicate value is within 90% to 110% of actual concentration at 95% confidence.

d - Control measures indicate value is within 75% to 125% of actual concentration at 95% confidence.

e - Control measures indicate value is within 50% to 150% of actual concentration at 95% confidence.

f - Control measures indicate value was not quantified.

Table F-4 (continued)
DISSOLVED AND TOTAL METAL ANALYSIS RESULTS
FOR THE ZONE 1 WELLS
SCA MODEL CITY FACILITY

Element(a)	Well Z-11			Well Z-13			Well Z-19			Well Z-21		
	Dissolved Value	Total Value		Dissolved Value	Total Value		Dissolved Value	Total Value		Dissolved Value	Total Value	
Al	< 66. b	< 120.		< 66.	2,280. d		< 66.	< 120.		< 66.	< 120.	
Sb	< 170.	< 170.		< 170.	< 170.		< 170.	< 170.		< 170.	< 170.	
As	< 8.	< 12.		< 7.	< 11.		< 8.	< 10.		< 7.	< 11.	
Ba	36. c	< 66.		128. c	152. c		< 33.	< 66.		56. c	< 66.	
Be	< 0.9	< 1.7		< 0.9	< 1.7		< 0.9	< 1.7		< 0.9	< 1.7	
Cd	< 9.	< 18.		< 9.	< 18.		< 9.	< 18.		< 9.	< 18.	
Ca	184,000. e	172,000. e		171,000. e	196,000. e		372,000. e	361,000. e		218,000. e	210,000. e	
Cr	< 10.	< 18.		< 10.	< 18.		< 10.	< 18.		< 10.	< 18.	
Cu	< 11.	< 22.		< 11.	< 22.		< 11.	< 22.		< 11.	< 22.	
Cu	< 8.	< 16.		< 8.	18. d		< 8.	< 16.		< 8.	< 16.	
Fe	< 43.	< 380.		< 43.	4,100. e		355. d	470. e		1,300. d	1,650. e	
Pb	< 20.	< 29.		< 11.	< 20.		< 120.	< 29.		< 21.	16.	
Hg	75,100. e	69,900. e		95,400. e	90,300. e		133,000. e	128,000. e		151,000. e	144,000. e	
Mn	824. e	f		631. e	f		940. e	f		4,000. e	f	
Hg	< 0.1	< 0.1		< 0.1	< 0.1		< 0.1	< 0.1		< 0.1	< 0.1	
Ni	< 15.	< 18.		< 15.	< 18.		30. d	30. d		< 15.	< 18.	
K	3,200. e	f		3,230. e	f		4,250. e	f		2,160. e	f	
Se	< 13.	< 13.		< 11.	< 11.		< 15.	< 10.		< 15.	< 10.	
Ag	< 12.	f		< 12.	f		< 12.	f		< 12.	f	
Na	184,000. e	170,000. d		55,100. e	50,800. d		170,000. e	165,000. d		156,000. e	150,000. d	
Tl	< 16.	f		< 27.	f		< 20.	f		< 22.	f	
Sn	< 97.	< 150.		< 97.	< 150.		< 97.	< 150.		< 97.	< 150.	
V	< 10.	< 12.		< 10.	< 12.		< 10.	< 12.		< 10.	< 12.	

a - Concentrations in ug/L

b - < X denotes sample concentration is less than X at 99% confidence.

c - Control measures indicate value is within 90% to 110% of actual concentration at 95% confidence.

d - Control measures indicate value is within 75% to 125% of actual concentration at 95% confidence.

e - Control measures indicate value is within 50% to 150% of actual concentration at 95% confidence.

f - Control measures indicate value was not quantified.

Table F-5

DISSOLVED AND TOTAL METAL ANALYSIS RESULTS
FOR THE ZONE 3 WELLS
SCA MODEL CITY FACILITY

Element(a)	Well B-21A		Well B-22B		Well B-34A		Well B-35A	
	Dissolved Value	Total Value	Dissolved Value	Total Value	Dissolved Value	Total Value	Dissolved Value	Total Value
Al	< 66. b	126,000. d	< 66.	7,100. d	< 66.	522. d	< 66.	2,350. d
Sn	< 170.	< 170.	< 170.	< 170.	< 170.	< 170.	< 170.	< 170.
As	6. d	87. e	7. d	11. e	12. d	16. e	< 8.	< 15.
Ba	434. c	919. c	64. c	67. c	< 33.	< 66.	< 33.	< 66.
Bu	< 0.9	6. e	< 0.9	< 1.7	< 0.9	< 1.7	< 0.9	< 1.7
Co	< 9.	f	< 9.	< 18.	< 9.	< 18.	< 9.	< 18.
Ca	33,000. e	492,000. e	58,000. e	68,000. e	49,400. e	54,500. e	185,000. e	190,000. e
Cr	< 10.	181. e	< 10.	< 18.	< 10.	< 18.	< 10.	< 18.
Cu	< 11.	113. e	< 11.	< 22.	< 11.	< 22.	< 11.	< 22.
Cu	< 8.	97. d	< 8.	< 16.	< 8.	< 16.	< 8.	< 16.
Fe	< 43.	205,000. e	< 43.	8,570. e	< 43.	1,060. e	< 43.	3,910. e
Pb	< 8.	f	< 8.	< 25.	< 12.	< 33.	< 9.	< 20.
Mg	12,200. e	104,000. e	24,100. e	26,500. e	61,500. e	65,400. e	76,100. e	80,400. e
Mn	37. e	f	56. e	f	< 24.	f	118. e	f
Hg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ni	< 15.	217. d	< 15.	< 18.	< 15.	< 18.	< 15.	< 18.
K	5,360. e	f	9,480. e	f	10,500. e	f	18,000. e	f
Se	< 12.	< 190.	< 12.	< 120.	< 10.	< 13.	< 16.	< 140.
Ag	< 12.	f	< 12.	f	< 12.	f	< 12.	f
Na	101,000. e	92,200. d	202,000. e	196,000. d	175,000. e	176,000. d	236,000. e	226,000. d
Tl	< 21.	f	< 24.	f	< 7.	f	< 110.	f
Sn	< 97.	< 150.	< 97.	< 150.	< 97.	< 150.	< 97.	< 150.
V	< 10.	254. d	< 10.	13. d	< 10.	< 12.	< 10.	< 12.
=====	=====	=====	=====	=====	=====	=====	=====	=====

a - Concentrations in ug/L

b - < X denotes sample concentration is less than X at 99% confidence.

c - Control measures indicate value is within 90% to 110% of actual concentration at 95% confidence.

d - Control measures indicate value is within 75% to 125% of actual concentration at 95% confidence.

e - Control measures indicate value is within 50% to 150% of actual concentration at 95% confidence.

f - Control measures indicate value was not quantified.

Table F-5 (continued)

DISSOLVED AND TOTAL METAL ANALYSIS RESULTS
FOR THE ZONE 3 WELLS
SCA MODEL CITY FACILITY

Element(a)	Well B-84A			Well B-111			Well B-113			Well B-114			Well B-116		
	Dissolved Value	Total Value		Dissolved Value	Total Value		Dissolved Value	Total Value		Dissolved Value	Total Value		Dissolved Value	Total Value	
Al	459. c	76,000. d		< 66. b	1,350. d		< 66. c	9,140. d		< 66. d	780. d		< 66. d	18,000. d	
Sb	< 170.	< 170.		< 170.	< 170.		< 170.	< 170.		< 170.	< 170.		< 170.	< 170.	
As	< 7.	44. e		3. e	7. e		8. d	13. e		< 9.	< 12.		6. d	11. e	
Ba	426. c	472. c		< 33.	< 66.		< 33.	120. c		< 33.	< 66.		< 33.	296. c	
Be	< 0.1	1.6 e		< 0.9	< 1.7		< 0.9	< 1.7		< 0.9	< 1.7		< 0.9	1.3 e	
Cd	< 9.	f		< 9.	< 18.		< 9.	< 18.		< 9.	< 18.		< 9.	< 18.	
Ca	11,000. e	222,000. e		491,000. e	505,000. e		54,700. e	90,200. e		297,000. e	272,000. e		30,000. e	132,000. e	
Cr	< 10.	117. e		< 10.	< 18.		< 10.	< 18.		< 10.	< 18.		< 10.	32. e	
Co	< 11.	71. e		< 11.	< 22.		< 11.	< 22.		< 11.	< 22.		< 11.	22. e	
Cu	< 8.	104. d		< 8.	< 16.		< 8.	23. d		< 8.	< 16.		< 8.	29. d	
Fe	794. d	129,000. e		866. d	2,760. e		< 43.	15,000. e		589. d	1,880. e		< 43.	35,000. e	
Pb	< 9.	f		< 20.	< 54.		< 8.	< 21.		< 10.	f		< 12.	< 19.	
Hg	11,900. e	81,800. e		66,300. e	68,200. e		67,400. e	67,300. e		36,500. e	33,600. e		53,900. e	75,400. e	
Mn	38. e	f		719. e	f		< 24.	f		434. e	f		81. e	f	
Ug	< 0.1	< 0.1		< 0.1	< 0.1		< 0.1	< 0.1		< 0.1	< 0.1		< 0.1	< 0.1	
Ni	< 15.	137. d		< 15.	< 18.		< 15.	< 18.		< 15.	< 18.		< 15.	41. d	
K	14,000. e	f		27,300. e	f		7,550. e	f		15,200. e	f		6,320. e	f	
Se	< 17.	< 200.		< 10.	< 20.		< 12.	< 16.		< 20.	< 26.		< 10.	< 120.	
Ag	< 12.	f		< 12.	f		< 12.	f		< 12.	f		< 12.	f	
Na	149,000. e	134,000. d		523,000. e	516,000. d		214,000. e	187,000. d		242,000. e	230,000. d		84,200. e	86,400. d	
Yl	< 23.	f		< 7.	f		< 110.	f		< 96.	f		< 12.	f	
Sn	< 97.	< 150.		< 97.	< 150.		< 97.	< 150.		< 97.	< 150.		< 97.	< 150.	
V	< 10.	155. d		< 10.	< 12.		< 10.	22. d		< 10.	< 12.		< 10.	39. d	

a - Concentrations in ug/L

b - < X denotes sample concentration is less than X at 99% confidence.

c - Control measures indicate value is within 90% to 110% of actual concentration at 95% confidence.

d - Control measures indicate value is within 75% to 125% of actual concentration at 95% confidence.

e - Control measures indicate value is within 50% to 150% of actual concentration at 95% confidence.

f - Control measures indicate value was not quantified.

Table F-6

GENERAL CONSTITUENTS ANALYSIS RESULTS
FOR THE ZONE 1 WELLS
SCA MODEL CITIES FACILITY

Parameter	Units	Well Z-3	Well Z-4	Well Z-5	Well Z-9	Well Z-11	Well Z-13	Well Z-19	Well Z-21
		Value	Value	Value	Value	Value	Value	Value	Value
pH (c)	Units	7.1	7.5	7.3	7.1	7.1	6.7	7.1	7.3
Conductance (d)	umhos/cm	1000.	820.	1380.	1960.	1630.	1610.	2680.	2390.
Turbidity (e)	NTU	10.	15.	10.	15.	4.0	300.	3.5	30.
Al (f)	ug/L (l)	289.	< 6. (a)	< 6.	< 6.	< 6.	< 6.	< 6.	< 6.
As (g)	ug/L Cl	278.	< 20.	< 20.	< 20.	96.	53.	67.	23.
Pb (h)	mg/L C	0.2	0.1	0.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
NPbC (h)	mg/L C	5.6	4.4	5.6	11.	4.5	5.5	6.7	5.7
Chloride (i)	mg/L Cl-	NA	NA	NA	74.	65.	67.	146.	160.
Sulfate (i)	mg/L SO4=	NA	NA	NA	660.	724.	316.	1440.	840.
Ammonia (j)	mg/L N	NA	NA	NA	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Cyanide (k)	ug/L CN-	NA	NA	NA	< 6.	20.	< 6.	22.	< 6.
Phenol	ug/L	< 40.	< 40.	< 40.	< 40.	< 40.	< 40.	< 40.	< 40.
=====	=====	=====	=====	=====	=====	=====	=====	=====	=====

a - < X denotes sample concentration is less than X at 99% confidence.

b - NA denotes not analyzed

c - Values are within 0.2 units.

d - Values are estimated to be 100 umhos/cm low.

e - Values are of unknown reliability because of lack of control measures.

f - Values may be 20% low.

g - Values may be 16 ug/L or 30% low and values below 40 ug/L may be unreliable.

h - Values are of questionable reliability because of the lack of field blanks.

j - Control measures indicate detectable values are within 90% to 110% of the actual concentrations.

i - Control measures indicate detectable values are within 75% to 125% of the actual concentrations.

k - Values are of questionable reliability because of suspected lab contamination and holding times.

Table F-7

GENERAL CONSTITUENTS ANALYSIS RESULTS
FOR THE ZONE 3 WELLS
SCA MODEL CITIES FACILITY

Parameter	Units	Well B-21A	Well B-228	Well B-34A	Well B-35A	Well B-84A	Well B-111	Well B-113	Well B-114	Well B-116
pH (c)	Units	7.8	7.5	7.1	8.0	NA (b)	7.1	7.4	7.5	7.3
Conductance (d)	umhos/cm	750.	1270.	1270.	2180.	NA	3480.	1510.	2180.	600.
Turbidity (e)	NTU	>1000.	65.	20.	50.	NA	30.	75.	15.	25.
P0X (f)	ug/L Cl	< 6. (a)	< 6.	6.	< 6.	< 6.	< 6.	< 6.	< 6.	< 6.
T0X (g)	ug/L Cl	< 20.	< 20.	< 20.	< 20.	< 20.	78.	< 20.	< 20.	76.
P0C (h)	mg/L C	0.21	< 0.1	0.19	< 0.1	< 0.1	0.70	< 0.1	< 0.1	NA
NPOC (h)	mg/L C	2.4	1.5	3.8	2.9	2.0	2.8	2.3	8.8	3.9
Chloride (i)	mg/L Cl-	56.	169.	NA	114.	NA	NA	203.	52.	NA
Sulfate (i)	mg/L SO4=	480.	378.	NA	1140.	NA	NA	368.	1390.	NA
Ammonia (j)	mg/L N	< 0.4	0.6	NA	0.7	NA	NA	< 0.4	1.3	NA
Cyanide (k)	ug/L CN-	< 6.	< 6.	NA	8.	NA	NA	< 6.	< 6.	NA
Phenol	ug/L	< 40.	< 40.	< 40.	< 40.	< 40.	< 40.	< 40.	< 40.	< 40.

a - < X denotes sample concentration is less than X at 99% confidence.

b - NA denotes not analyzed

c - Values are within 0.2 units.

d - Values are estimated to be 100 umhos/cm low.

e - Values are of unknown reliability because of lack of control measures.

f - Values may be 20% low.

g - Values may be 16 ug/L or 30% low and values below 40 ug/L may be unreliable.

h - Values are of questionable reliability because of the lack of field blanks.

i - Control measures indicate detectable values are within 90% to 110% of the actual concentrations.

j - Control measures indicate detectable values are within 75% to 125% of the actual concentrations.

k - Values are of questionable reliability because of suspected lab contamination and holding times.

Table F-8

LEACHATE SAMPLE ANALYSIS TECHNIQUES AND METHODS

Parameter =====	Analytical Technique =====	Method Reference =====
Mercury	Wet digestion, Cold Vapor AAS	Method 245.1 (a)
Sb, As and Se	Aqua regia digestion, Zeeman Furnace AAS with standard additions	NEIC Method (b)
Other Elements	Aqua regia digestion, ICAP-OES	NEIC Method
Ammonia	No distillation, filtration, Colorimetry, Auto-Salicylate	Modified Method 351.2 (a)
Cyanide	Manual distillation, Colorimetry, Auto-Barbituric Acid	Method 335.2 (a) Method 335.3 (a)
Fluoride	No distillation, Ion selective potenti- ometry with known additions	Modified Method 340.2 (a)
Other Anions	Ion chromatography	NEIC Method
Water	Coulometric Karl Fischer Titration Methanol extraction for the oily samples	NEIC Method
Gross Alpha and Beta	Evaporation, Gas flow Proportional Counting	EPA 600/4-80-032
Volatiles	Purge and trap GC-MS Sample volume dependent on concentration	Method 624 (c)
Semi-volatiles	Methylene Extraction, GC-MS Sample volume dependent on concentration	Method 625 (c)
Pesticides and PCBs	Hexane extraction, GC-PC Sample volume dependent on concentration	Method 608 (c)
=====	=====	=====

a - Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020.

b - NEIC Laboratory Services Division Method

c - Federal Register, Vol 49, October 26, 1984.

Table F-9

VOLATILE ORGANIC ANALYSIS OF LEACHATE SAMPLES

Concentration Units Are Micrograms/Liter (ug/L) Except As Noted

Landfill Sump Number	SLF 7 29			SLF 7 28			SLF 7 27			SLF 7 26		
	Value	LQ		Value	LQ		Value	LQ		Value	LQ	
Volatile Priority Pollutant Compounds												
Benzene	800.	500.	5000.		1000.		500.	100.		800.	300.	
Carbon Tetrachloride	.	.	PBL		1000.		.	.		.	.
Chlorobenzene	.	.	6000.		1000.		.	.		.	.
1,2-Dichloroethane	8000.	1000.	28000.		2000.		.	.		57000.	700.	
1,1,1-Trichloroethane	.	.	5000.		1000.		.	.		.	.
1,1-Dichloroethane	PBL	1500.	PBL		3000.		.	.		1800.	300.	
1,1,2-Trichloroethane	.	.	PBL		1000.		.	.		.	.
1,1,2,2-Tetrachloroethane	.	.	PBL		3000.		3500.	300.		.	.	
Chloroform	3000.	1500.	14000.		3000.		.	.		.	.
trans-1,2-Dichloroethene	.	.	.		.		2300.	300.		.	.	
Ethylbenzene	1000.	500.	69000.		1000.		.	.		.	.
Methylene Chloride	45000.	1500.	480000.		3000.		1800.	300.		34000.	1000.	
Tetrachloroethene	PBL	500.	1000.		1000.		2800.	100.		.	.	
Toluene	.	.	69000.		1000.		100.	100.		6300.	300.	
Trichloroethene	.	.	10000.		2000.		3400.	200.		.	.	
Volatile Non-Priority Pollutant Compounds												
Tetrahydrofuran	68000.	7500.	150000.		15000.		6000.	1500.		35000.	5000.	
Methyl Ethyl Ketone (MEK)	55000.	7500.	390000.		30000.		.	.		50000.	5000.	
1,2-Dibromoethane (EDB)	.	.	8000.		5000.		.	.		.	.
Isopropylether	TENT	.	.		.		.	.		.	.
Benzeneamine	TENT	.	.		.		.	.		.	.
Methyl Acetate	.	.	TENT		.		.	.		.	.
Isopropyl Acetate	.	.	TENT		.		.	.		.	.
Butyl Acetate	.	.	TENT		.		.	.		.	.
m-Xylene	2000.	100.	140000.		1000.		.	.		.	.
o- and/or p-Xylene	2800.	500.	140000.		1000.		.	.		600.	300.	
4-Methyl-2-pentanone (MIBK)	TENT	.	TENT		.		.	.		.	.
Acetone	320000.	25000.	1000000.		50000.		14000.	5000.		130000.	20000.	
2-Propanol	120000.	15000.	1200000.		30000.		25000.	3000.		130000.	7000.	
Ethyl Acetate	.	.	TENT		.		.	.		.	.
2-Methyl-2-propanol	TENT	.	TENT		.		TENT	.		TENT	.	
4-Methyl-2-pentanol	3000.	2500.	14000.		5000.		PBL	500.		10000.	2000.	
2-Methyl-2-butanol	PBL	2500.	71000.		5000.		PBL	500.		.	.	
2-Hexanone	3000.	2500.	14000.		5000.		.	500.		PBL	2000.	
Ethyl Ether	35000.	7500.	490000.		20000.		PBL	2000.		PBL	7000.	
2-Butanol	.	.	.		.		.	.		.	.

Table F-9 (continued)

VOLATILE ORGANIC ANALYSIS OF LEACHATE SAMPLES

Concentration Units Are Micrograms/Liter (ug/L) Except As Noted

Landfill Sump Number	SLF 10 32		SLF 6 15		SLF 5 10		SLF 4 08	
	Value	LOQ	Value	LOQ	Value	LOQ	Value	LOQ
Volatile Priority Pollutant Compounds								
Benzene	.	.	3000.	1000.	PBL	50000.	6000.	500.
Carbon Tetrachloride	.	.	.	.	70000.	50000.	6000.	500.
Chlorobenzene	.	.	2000.	1000.	70000.	50000.	3000.	500.
1,2-Dichloroethane	.	.	19000.	2000.	.	.	.	.
1,1,1-Trichloroethane	1100.	200.	9000.	1000.	100000.	50000.	8900.	500.
1,1-Dichloroethane	600.	600.	3000.	3000.	.	.	.	.
1,1,2-Trichloroethane	.	.	.	.	60000.	50000.	70000.	500.
1,1,2,2-Tetrachloroethane	.	.	.	.	500000.	150000.	180000.	1500.
Chloroform	PBL	600.	18000.	3000.	PBL	50000.	55000.	1500.
trans-1,2-Dichloroethene	.	.	.	.	100000.	50000.	1700.	500.
Ethylbenzene	3600.	600.	620000.	3000.	210000.	50000.	130000.	15000.
Methylene Chloride	300.	200.	PBL	1000.	510000.	50000.	37000.	500.
Tetrachloroethene	400.	200.	11000.	1000.	300000.	100000.	60000.	1000.
Toluene	400.	400.	14000.	2000.	.	.	.	.
Trichloroethene	4000.	3000.	.	.	600000.	150000.	220000.	15000.
Tetrahydrofuran	6000.	3000.	.	.	280000.	150000.	19000.	1500.
Methyl Ethyl Ketone (MEK)	.	.	.	.	.	.	.	.
1,2-Dibromoethane (EDB)	.	.	TENT	.	.	.	TENT	.
Isopropylether	.	.	.	.	.	.	TENT	.
Pentachloroethane	.	.	.	.	.	.	TENT	.
Trifluoromethylbenzene	.	.	.	.	.	.	TENT	.
Dibromomethane	.	.	.	.	.	.	TENT	.
Chloro(trifluoromethyl)benzene	.	.	.	.	.	.	130000.	25000.
Bromochloromethane	.	.	.	.	.	.	.	.
Dimethyl Mercaptan	.	.	TENT	.	.	.	4000.	1000.
m-Xylene	.	.	.	.	200000.	100000.	2500.	500.
o- and/or p-Xylene	.	.	.	.	170000.	50000.	TENT	.
4-Methyl-2-pentanone (MIBK)	TENT	10000.	TENT	.	PBL	250000.	1000000.	50000.
Acetone	50000.	6000.	.	.	3000000.	1000000.	330000.	30000.
2-Propanol	68000.	.	.	.	.	.	.	.
Ethyl Acetate	TENT	.	TENT	.	.	.	TENT	.
2-Methyl-2-propanol	PBL	1000.	.	.	24000.	.	2500.	2500.
4-Methyl-2-pentanol	.	.	.	.	PBL	.	15000.	2500.
2-Methyl-2-butanol	.	.	.	.	.	.	.	.
2-Hexanone	.	.	PBL	6000.	.	.	.	.
Ethyl Ether	PBL	4000.	.	.	.	.	20000.	10000.
2-Butanol	.	.	.	.	.	.	.	.

LOQ = Limit of Quantitation
PBL = Present But Below LOQ

SEMIVOLATILE AND PCB RESULTS FOR LEACHATES

Concentration Units Are Micrograms/Liter (ug/L) Except As Noted

[illegible]

Table F-10 (continued)

SEMIVOLATILE AND PCB RESULTS FOR LEACHATES

Concentration Units Are Micrograms/Liter (ug/L) Except As Noted

Landfill Sump Number	SLF 7 26		SLF 10 32		SLF 6 15	
	Value	LQ	Value	LQ	Value	LQ
Semivolatile Priority Pollutant Compounds						
1,2,4-Trichlorobenzene	.	.	.	.	PBL	100.
Hexachlorobenzene	.	.	.	.	.	.
Hexachloroethane	.	.	.	.	.	.
Bis(2-chloroethyl)ether	.	.	.	.	.	.
2-Chlorophenol	.	.	.	.	PBL	100.
1,2-Dichlorobenzene	.	.	PBL	500.	1000.	100.
1,3-Dichlorobenzene	.	.	.	.	PBL	100.
1,4-Dichlorobenzene	.	.	.	.	1000.	100.
2,4-Dimethylphenol	.	.	.	.	.	.
Hexachlorobutadiene	.	.	.	.	.	.
Isophorone	PBL	5000.	1300.	500.	.	.
Naphthalene	.	.	.	.	.	.
N-Nitrosodiphenylamine	.	.	.	.	.	.
Phenol	60000.	10000.	2000.	1000.	1300.	200.
Bis(2-ethylhexyl)phthalate	.	.	.	.	1000.	200.
Di-n-butylphthalate	11000.	.	.	.	PBL	200.
Dimethylphthalate	PBL	5000.	.	.	.	.
Semivolatile Nonpriority Pollutant Compounds						
Benzyl Alcohol and/or p-Cresol	80000.	50000.	PBL	1000.	PBL	1000.
Benzoic Acid	.	.	PBL	5000.	.	.
Aniline	.	.	.	.	.	.
Hexenol	TENT	.	TENT	.	.	.
1-Methyl-2-pyrrolidinone	TENT	.	TENT	.	.	.
Methyl Phenol	.	.	.	.	TENT	.
C8-C19 Alkanes	.	.	TENT	.	.	.
Cyclohexene	.	.	TENT	.	.	.
N,N-Dimethyl Formamide	TENT	.	.	.	.	.
Dichloro-benzoic Acid	TENT	.	.	.	.	.
Heptyl Hexyl Ether	.	.	TENT	.	.	.
Octahydrohexamethyl-1h-Indene	.	.	TENT	.	.	.
Cyclohexane	.	.	.	.	TENT	.
Chlorophenol	.	.	.	.	TENT	.
Methyl Benzoic Acid	.	.	.	.	TENT	.
Bromobenzene	.	.	.	.	.	.
Chloro-(trifluoromethyl)-benzene	.	.	.	.	.	.
Dichloro-(trifluoromethyl)-benzene	.	.	.	.	.	.
Trichloro-(trifluoromethyl)-benzene	.	.	.	.	.	.
Tetrachloro-(trifluoromethyl)-benzene	.	.	.	.	.	.
N,N-Dimethyl Acetamide	.	.	.	.	.	.
2-Butoxy Ethanol	.	.	.	.	.	.
Chlorotoluene	.	.	.	.	.	.
(1-Methylethyl)phenol	.	.	.	.	.	.
PCBs/pesticides						
PCB 1242 (ug/kg)	.	.	.	.	300.	200.
PCB 1254 (ug/kg)	.	.	.	.	700.	500.

LQ = Limit of Quantitation

PBL = Present But Below LQ

TENT = Tentative Identification, No Standard Analyzed

Table F-10 (continued)

SEMIVOLATILE AND PCB RESULTS FOR LEACHATES

Concentration Units Are Micrograms/Liter (ug/L) Except As Noted

Landfill Sump Number	COMPOUND	SLF 15 10 aqueous		SLF 15 10 non-aqueous (ug/Kg)		SLF 4 08	
		VALUE	LQ	VALUE	LQ	VALUE	LQ
		Semivolatile Priority Pollutant Compounds					
	1,2,4-Trichlorobenzene	19000.	5000.	7000000.	1000000.	29000.	5000.
	Hexachlorobenzene	PBL	10000.	PBL	2000000.	10000.	10000.
	Hexachloroethane	PBL	10000.	2000000.	2000000.	10000.	10000.
	Bis(2-chloroethyl)ether					PBL	5000.
	2-Chlorophenol						
	1,2-Dichlorobenzene	20000.	5000.	7000000.	1000000.	20000.	5000.
	1,3-Dichlorobenzene					PBL	5000.
	1,4-Dichlorobenzene	9000.	5000.	3000000.	1000000.	7000.	5000.
	2,4-Dimethylphenol	PBL	10000.	PBL	2000000.		
	Hexachlorobutadiene			PBL	2000000.	30000.	10000.
	Isophorone						
	Naphthalene					PBL	4000.
	N-Nitrosodiphenylamine						
	Phenol	100000.	10000.	3000000.	2000000.	30000.	10000.
	Bis(2-ethylhexyl)phthalate	PBL	10000.	3000000.	2000000.	10000.	10000.
	Di-n-butylphthalate			PBL	2000000.	PBL	10000.
	Diethylphthalate						
	Dimethylphthalate						
	Semivolatile Nonpriority Pollutant Compounds						
	Chlorobenzoic Acid					TENT	
	1,2,4,5-Tetrachlorobenzene			PBL	2000000.	10000.	10000.
	Benzyl Alcohol and/or p-Cresol					PBL	10000.
	Benzoic Acid	PBL	50000.			180000.	50000.
	Aniline					50000.	10000.
	p-Chloroaniline					PBL	10000.
	Pentachlorobenzene			PBL	2000000.	20000.	10000.
	N,N-Dimethyl Formamide	TENT				TENT	
	Bromobenzene	TENT		TENT			
	Chloro-(trifluoromethyl)-benzene	TENT		TENT		TENT	
	Dichloro-(trifluoromethyl)-benzene	TENT		TENT		TENT	
	Trichloro-(trifluoromethyl)-benzene	TENT		TENT		TENT	
	Tetrachloro-(trifluoromethyl)-benzene	TENT		TENT		TENT	
	N,N-Dimethyl Acetamide	TENT				TENT	
	2-Butoxy Ethanol	TENT				TENT	
	(1-Methyl)phenol	TENT		TENT			
	Chlorotoluene	TENT		TENT			
	Trifluoromethylaniline						
	1-Chlorononane					TENT	
	Benzenesulfonic Acid					TENT	
	Trichloromethylbenzene					TENT	
	Biphenyl					TENT	
	PCBs/Pesticides						
	PCB 1242 (ug/Kg)	15,000.	2000.	66,000,000.	2,000,000.	240,000.	20,000.
	PCB 1254 (ug/Kg)						
	alpha-BHC (Determined only in 08)					5400.	2000.
	gamma-BHC (Determined only in 08)					7800.	2000.
	LOQ = Limit Of Quantitation PBL = Present But Below LOQ						

LQ = Limit Of Quantitation

PBL = Present But Below LQ

Table F-11

F-23

NEIC LIMITS OF QUANTITATION FOR ORGANIC
COMPOUNDS IN SCA LEACHATE SAMPLES

To find limits of quantitation for compounds not detected in leachate samples, multiply the concentration in the table by the factor indicated. Units for nonaqueous phases are $\mu\text{g/kg}$. Limits of detection for PCBs were 200 to 500 $\mu\text{g/kg}$ in samples where no PCBs were detected.

Limit of Quantitation ($\mu\text{g/l}$)		Limit of Quantitation ($\mu\text{g/l}$)		Multiplication Factors
<u>Base/Neutral Compounds</u>		<u>Acid Compounds</u>		<u>Volatile Compounds</u>
Acenaphthene	20	2,4,6-Trichlorophenol	20	x1: field blanks
1,2,4-trichlorobenzene	10	Parachlorometacresol	20	x50: 27 ^a
Hexachlorobenzene	20	2-Chlorophenol	10	x100: 15, 32
Hexachloroethane	20	2,4-Dichlorophenol	20	x167: 25
bis(2-Chloroethyl)ether	10	2,4-Dimethylphenol	20	x250: 08, 29
2-Chloronaphthalene	10	2-Nitrophenol	20	x500: 28-aqueous
1,2-Dichlorobenzene	10	4-Nitrophenol	30	x25000: 10-aqueous
1,3-Dichlorobenzene	10	2,4-Dinitrophenol	40	
1,4-Dichlorobenzene	10	4,6-Dinitro-o-cresol	20	<u>Base/Neutral and Acid Compounds</u>
2,4-Dinitrotoluene	20	Pentachlorophenol	20	
2,6-Dinitrotoluene	20	Phenol	20	x10: 15, field blanks
1,2-Diphenylhydrazine ^b	20	Benzoic acid	100	x50: 08, 10-aqueous, 27, 32
Fluoranthene	8	4-Methylphenol (p-cresol)	20	x500: 26, 28-aqueous, 29
4-Chlorophenyl phenyl ether	10	2-Methylphenol (o-cresol)	20	x5000: 10-nonaqueous,
4-Bromophenyl phenyl ether	20	2,4,5-Trichlorophenol	20	28-nonaqueous
bis(2-Chloroisopropyl)ether	20			
bis(2-Chloroethoxy)methane	10	<u>Volatile Compounds</u>		
Hexachlorobutadiene	20	Benzene	2	
Hexachlorocyclopentadiene	20	Bromodichloromethane	2	
Isophorone	10	Baromofom	2	
Naphthalene	8	Bromomethane	4	
Nitrobenzene	10	Carbon Tetrachloride	2	
N-nitrosodimethylamine	NA ^c	Chlorobenzene	2	
N-nitrosodiphenylamine ^c	10	Chloroethane	6	
N-nitrosodi-n-propylamine	20	Chloroform	6	
Bis(2-Ethylhexyl)phthalate	20	Chloromethane	12	
Butylbenzylphthalate	20	Dibromochloromethane	2	
Di-n-butylphthalate	20	1,1-Dichloroethane	6	
Di-n-octylphthalate	20	1,2-Dichloroethane	4	
Diethylphthalate	10	1,1-Dichloroethene	4	
Dimethylphthalate	20	trans-1,2-Dichloroethene	6	
Benzo(a)anthracene	20	1,2-Dichloropropane	2	
Benzo(a)pyrene	20	Ethylbenzene	2	
Benzo(b)fluoranthene and/or		Methylene chloride	6	
Benzo(k)fluoranthene	20	1,1,2,2-Tetrachloroethane	6	
Chrysene	20	Tetrachloroethene	2	
Acenaphthylene	10	Toluene	2	
Anthracene	10	1,1,1-Trichloroethane	2	
Benzo(g,h,i)perylene	40	1,1,2-Trichloroethane	2	
Fluorene	10	Trichloroethene	4	
Phenanthrene	10	Vinyl chloride	10	
Dibenzo(a, h)anthracene	40	Acetone	100	
Indeno(1,2,3-c,d)pyrene	40	2-Butanone (MEK)	30	
Pyrene	10	1,2-Dibromomethane (E08)	10	
Benzo(d)pyrene	NA	2-Hexanone	20	
3,3'-Dichlorobenzidine	NA	xylene	8	
Aniline	20	2-Butanol	40	
Benzyl chloride	40	Ethyl Ether	12	
Benzyl alcohol	20	2-Methyl-2-butanol	20	
o-Chloroaniline	20	4-Methyl-2-pentanol	20	
Dibenzofuran	10	2-Methyl-2-propanol	100	
2-Methylnaphthalene	10	4-Penten-2-ol	100	
4-Nitroaniline	20	2-Propanol	60	
Pentachlorobenzene	20	Tetranhydrofuran	30	
1,2,4,5-Tetrachlorobenzene	20			
1,2,3,4-Tetrachlorobenzene	20			
Pentachloronitrobenzene	10			
2-Methylnaphthalene	10			
2-Nitroaniline	100			
3-Nitroaniline	100			

^a Sump number^b Measured as Azobenzene^c Measured as diphenylamine^d Not Analyzed

Table F-12
METALS ANALYSIS RESULTS FOR THE LEACHATE SAMPLES
SCA MODEL CITY, NY

Landfill Sump Number	SLF 4 08	SLF 6 15	SLF 5 10	SLF 7 26	SLF 7 27	SLF 7 28	SLF 7 29	SLF 10 32
Elmt	Value(a)	Value	Value	Value	Value	Value	Value	Value
Al	14,000. e	< 4,000. b	850,000. e	< 4,000.	< 4,000.	< 4,000.	< 4,000.	15,000. e
Sb	220. d	< 50.	< 400.	430. d	260. d	< 50.	910. d	1,700. d
As	3,690. d	160. d	13,200. d	3,560. d	1,260,000. d	7,540. d	960,000. d	51,000. d
Ba	< 200.	< 200.	< 4,000.	< 200.	< 200.	< 200.	< 200.	< 200.
Be	< 70.	< 70.	< 1,000.	< 70.	< 70.	< 70.	< 70.	< 70.
Cd	1,440. d	< 30.	700. d	41,800. d	53,400. d	24,400. d	841,000. d	332,000. d
Ca	4,950,000. d	333,000. d	770,000. d	574,000. d	1,010,000. d	1,150,000. d	823,000. d	670,000. d
Cr	500. d	< 200.	102,000. d	900. d	< 200.	1,200. d	< 200.	< 200.
Cu	800. e	< 400.	< 8,000.	< 400.	< 400.	< 400.	< 400.	< 400.
Cu	860. c	110. c	2,800. c	220. c	< 40.	770. c	140. c	1,310. c
Fe	3,440,000. e	1,100. e	4,080,000. e	13,000. e	23,500. e	431,000. e	7,700. e	72,300. e
Pb	< 1,000.	< 500.	< 10,000.	< 500.	< 500.	< 500.	< 500.	< 500.
Hg	906,000. e	53,500. e	170,000. e	234,000. e	641,000. e	345,000. e	454,000. e	340,000. e
Mn	131,000. d	2,480. d	14,200. d	3,860. d	8,120. d	64,800. d	42,800. d	8,860. d
Hg	NA f	< 0.5	NA	2.3 c	< 0.5	NA	< 0.5	< 0.5
Mo	< 200.	< 200.	< 4,000.	2,400. d	< 200.	< 200.	< 200.	< 200.
Ni	24,400. d	< 100.	3,000. d	4,220. d	1,640. d	1,270. d	8,280. d	1,370. d
K	607,000. c	52,400. c	1,690,000. c	1,690,000. c	295,000. c	209,000. c	1,530,000. c	494,000. c
Sc	< 20.	< 20.	< 400.	< 20.	< 20.	< 20.	< 20.	< 20.
Se	1,390. d	< 50.	3,820. d	300. d	90. d	< 50.	490. d	230. d
Ag	< 50.	< 50.	< 50.	< 50.	< 50.	< 50.	< 50.	< 50.
Na	10,200,000. d	196,000. d	6,210,000. d	25,000,000. d	11,700,000. d	2,810,000. d	21,200,000. d	3,120,000. d
Sr	12,700. d	900. d	< 20,000.	11,600. d	5,600. d	4,800. d	6,100. d	3,400. d
Tl	< 900.	< 900.	< 18,000.	< 900.	< 900.	< 900.	< 900.	< 900.
Ti	360. d	< 60.	25,400. d	< 60.	< 60.	220. d	< 40.	410. d
V	400. d	< 100.	< 1,800.	130. d	200. d	700. d	150. d	170. d
Zn	38,800. d	< 200.	15,000. d	1,500. d	600. d	4,100. d	1,200. d	6,500. d

a - Concentrations are reported in ug/Kg.
b - < X means that the sample concentration is less than X at 99% confidence.
c - Control measures indicate value is within 90% to 110% of the actual concentration at 95% confidence.
d - Control measures indicate value is within 75% to 125% of the actual concentration at 95% confidence.
e - Control measures indicate value is within 50% to 150% of the actual concentration at 95% confidence.
f - NA is not analyzed.

Table F-13

GENERAL CONSTITUENT ANALYSIS RESULTS
FOR THE LEACHATE SAMPLES

Landfill Sump Number	Parameter	Units	SLF 4 08	SLF 6 15	SLF 5 10	SLF 7 26	SLF 7 27	SLF 7 28	SLF 7 29	SLF 10 32
			Value	Value	Value	Value	Value	Value	Value	Value
Water		%	39. a	98. b	24. a	94. b	96. b	95. a	93. b	98. b
Chloride (c)		mg/L Cl-	NA f	460.	NA	37,000.	20,000.	12,000.	59,000.	9,700.
Bromide (c)		mg/L Br-	NA	36.	NA	220.	690.	970.	560.	25.
Fluoride (c)		mg/L F-	NA	1.5	NA	11.	5.9	3.3	7.0	24.
Nitrate (d)		mg/L N	NA	< 0.5 e	NA	68.	32.	20.	38.	< 2.
Sulfate (c)		mg/L SO4=	NA	50.	NA	11,000.	3,700.	1,500.	5,800.	4,200.
Ammonia (c)		mg/L N	NA	8.7	NA	3,900.	1,400.	2,600.	5,000.	2,900.
Gross Alpha (g)		pCi/L	NA	55.	NA	1,200.	60.	1,500.	760.	150.
2 sigma		pCi/L	NA	9.	NA	150.	90.	600.	130.	50.
Gross beta (g)		pCi/L	NA	20.	NA	1,500.	NA	NA	780.	200.
2 Sigma		pCi/L	NA	5.	NA	150.	NA	NA	140.	60.

a - The oil content of the different sample containers varied widely.

b - Value is within 2% absolute.

c - Control measures indicate values are within 75% to 125% of actual concentrations at 95% confidence.

d - Control measures indicate values are within 50% to 150% of actual concentrations at 95% confidence.

e - < X means that the sample concentration is less than X at 99% confidence.

f - NA is not analyzed

g - The standard deviation of the results are indicated under 2 sigma (two standard deviations).

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