

ENVIRONMENT CANADA REVIEW OF LOVE CANAL REPORT

Environment Canada has reviewed a 4000-page report provided by the U.S. Environmental Protection Agency Environmental Monitoring at Love Canal - May 1982, as well as Interagency Review - May 1982, and Final Report on Groundwater Flow Modelling Study of the Love Canal Area by GeoTrans Inc. This review was carried out with the specific objective of determining whether or not the Love Canal will continue to be a source of toxic pollution to the Niagara River. U.S. authorities have confirmed that toxics from Love Canal have entered the Niagara River in the past from Cayuga Creek. [The Great Lakes Water Quality Agreement of 1978 states that it is the policy of Canada and the U.S. that the discharge of persistent toxic chemicals to transboundary waterways be virtually eliminated.]

The review makes no judgement concerning U.S. domestic decisions regarding the habitability of homes in the neighbourhood of Love Canal. This is a somewhat different problem than the seepage of pollutants into the bedrock aquifer which leads to the Niagara River.

The review concludes that the U.S. report contains insufficient data to determine that Love Canal will not continue to be a source of toxic pollution to the Niagara River. Environment Canada will therefore be requesting U.S. agencies to undertake further work to ensure that the water quality of the river is not adversely affected.

Specific conclusions of the Environment Canada review of the U.S. Love Canal report include:

1. The report does not constitute a complete hydrogeological site evaluation. This is essential to determine whether toxic substances now enter, or will in the future enter the groundwater below the site and move towards the Niagara River.
2. Since the report does not assess the extent of groundwater contamination, it is impossible to determine whether remedial strategies will be adequate to contain the wastes in the future.
3. { The data are inadequate to conclude that Love Canal is not now contaminating, or will not in the future contaminate the bedrock aquifer which enters the Niagara River.
4. The report's conclusions that low-level widespread contamination exists through the bedrock aquifer of Love Canal should be investigated further.
5. Clean-up of highly-contaminated storm sewers and creeks in the Love Canal area is essential to remove these sources of contaminants to the Niagara River.

The U.S. Environmental Protection Agency has recently announced that funds have been made available to undertake remedial work on Love Canal sewers and Black and Bergholtz Creeks. The U.S. has been providing Canadian federal and provincial authorities with scientific and technical reports pertaining to environmental contamination in the Niagara River area and has accelerated work on several projects under its Niagara River Agenda. Environment Minister John Roberts has welcomed these positive actions and he will continue to urge the U.S. to make every effort to solve the complex environmental problems affecting the Niagara River.

The review of the Love Canal report has been transmitted to the U.S. Environmental Protection Agency and will be discussed shortly at a consultative meeting between Canadian and U.S. agencies. Copies of the Environment Canada review have also been sent to the New York Department of Environmental Conservation, the Ontario Ministry of the Environment.

ENVIRONMENTAL MONITORING AT LOVE CANAL
ENVIRONMENT CANADA REVIEW - AUGUST 1982

INTRODUCTION

This review is based on a Department of the Environment (DOE) review of a three volume, 4000 page Environmental Protection Agency (EPA) report entitled "Environmental Monitoring at Love Canal", May 1982; "Environmental Monitoring at Love Canal Interagency Review" carried out jointly by the National Bureau of Standards, Health and Human Services and EPA; and "Final Report on Groundwater Flow Modelling Study of the Love Canal Area", by GeoTrans Inc.

The review does not include the two quality control, quality assurance documents by GCA Corporation, nor does it include reports entitled "Geophysical Investigation Results, Love Canal, New York", by Technos Inc., or "The Groundwater Monitoring Program at Love Canal", by JRB Associates. These documents, as of this date, have not been provided to Environment Canada.

The three volume EPA report was received by DOE on July 14. In spite of the relatively short time devoted to it, the opinions reflected in this analysis should provide an overall indication of the Environment Canada assessment of the Love Canal reports.

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Twisted
Correction

Of particular interest to Canadians are those aspects of the report which address the possible pathways of contaminants from the Love Canal site to the Niagara River, as distinct from questions which relate to the habitability of local neighbourhoods.

Our review therefore focused on answering the following questions based on the data presented in the Love Canal reports:

- I. Are we satisfied that toxic chemicals from Love Canal are not now, and will not in the future, enter the groundwater below the site and migrate to the Niagara River?
- II. Are we satisfied that other pathways such as transport of toxics by air and the re-mobilization of contaminated sediments in storm sewers and creeks in the area are not, and will not in the future affect the environment of Canadians?
- III. Are we satisfied that the scientific information and technical conclusions provided in the Love Canal reports are in fact based on adequate scientific data and analysis, and does the report give us the information we need to answer the first two questions?

CONCLUSIONS

- The Love Canal report does not constitute a complete hydro-geological site evaluation. Such an evaluation must be done before one can conclude that toxics are not now, nor will they be in the future, entering the groundwater below the site and move to the Niagara River.
- We are particularly troubled by the report's conclusion that low level widespread contamination was observed throughout the bedrock aquifer upstream of Love Canal.
- Because we don't know the extent of groundwater contamination, we don't know whether or not remedial strategies being proposed will be adequate in the future to contain the wastes.
- The data base does not provide the necessary confidence to conclude, whether or not Love Canal is affecting the bedrock aquifer now, or will in the future.
- In order to accept the view that Love Canal does not presently represent a significant source of airborne contaminants to Canadians, we would prefer to see quantitative as well as qualitative studies of airborne contaminants moving from the site.

- Highly contaminated storm sewers and creeks in the Love Canal area were a matter of concern in 1980 and remain so. Until evidence of clean-up activity is seen, we cannot conclude that the storm sewers and creeks will not continue to contaminate the Niagara River.

- Given the short time during which the study was planned and carried out, there is a very large amount of useful information which the Love Canal report has provided. The analysis of this data, however, has not been entirely adequate scientifically and the type and quantity of data that has been produced is not sufficient to satisfy Environment Canada that Love Canal is not at present, and will not in the future, be a source of contamination of persistent toxic substances to the Niagara River. We feel that some of the conclusions that have been drawn based on the short-term studies are not justified based on the scientific evidence presented.

I GROUNDWATER

Q. Are we satisfied that toxic chemicals from Love Canal are not now, nor will they in the future, enter the groundwater below the site and migrate to the Niagara River?

A. The data as provided in the Love Canal report did not indicate gross contamination of the bedrock aquifer in the vicinity of the site when the data were gathered two years ago. However, we are strongly of the opinion that the data constituted an inadequate information base from a hydrogeological site investigation point of view and therefore, that the study which was based on those data is inconclusive. [Based on this study then, we are not left with the assurance that toxics will be prevented from entering the bedrock aquifer below the site and will not migrate to the Niagara River. [We are particularly troubled by the fact that "low level widespread contamination was observed throughout the bedrock aquifer", (p. 164) whether or not it came from Love Canal.]

Discussion

Site Evaluation - One must bear in mind that the conclusions contained in the Love Canal study were in effect based on a three-month "snapshot" of hydrogeological conditions taken two years ago. In our opinion, insufficient time was allowed the EPA contractors to undertake a complete hydrogeological site evaluation. As a consequence, we don't know the extent and direction of groundwater movement in the overburden, how much has moved out of Love Canal, where it is and whether or not it will enter the Niagara River at some point in time. We do have some ideas of what is happening in the Dolomite bedrock, but are disturbed to see that it leads to conclusions of widespread low level contamination.

We feel that a complete hydrogeological and hydrogeochemical site evaluation should be done before one can, with confidence, conclude that toxics are not now, nor will they in the future, enter the bedrock aquifer below the site. On the one hand, while we are pleased to see that the EPA data provides a fair degree of reassurance that there is not "now" (i.e. two years ago) gross contamination of the bedrock aquifer below the site, the EPA report does not constitute a complete hydrogeological site investigation. Because we don't really know the extent of groundwater contamination, we don't know whether remedial strategies being proposed will be adequate in the future to contain the wastes.

We recognize that this report is an environmental monitoring report and is probably not intended to be a discussion of alternative remedial technologies and concepts.

Water Table - We do not know where the water table is located in the surficial deposits ("Shallow System") because only one set of water level measurements was taken and this seems to have been taken too soon after the installation of the monitoring wells to allow equilibration with the hydraulic heads within the shallow system.

We see in Figure 19, p. 72, EPA Vol. 1, that the data indicate a difference in "static" heads of as much as 11.6 feet. Consequently, it is impossible to draw reliable contours of the water table and this makes it difficult to evaluate the potential for contaminant migration, either within the shallow system or vertically to the Lockport Dolomite.

Pump and Slug Tests - Since only one test was run with only one shallow system observation well, the vertical interconnection between the shallow system and the Lockport Dolomite which underlies it, can only be defined quantitatively around the one observation well. Furthermore, only four slug tests (to determine local hydraulic conductivity) were undertaken in the shallow system, and these at a site far removed from Love Canal.

In the Lockport Dolomite, the most likely pathway of contaminants to the Niagara River, only one analyzable constant discharge or pump test (to determine regional hydraulic conductivity) was undertaken.

Sampling Techniques - The techniques used for sampling of groundwaters for chemical analysis are not described in the documents available to us. We would question, for example, whether those techniques would have prevented loss of volatile organics during sampling, especially given the very long (in weeks) lag times between sample collection and analysis. We would question whether the samples were representative.

Data Base - Based on this incomplete information then, the GeoTrans Inc. model (Final Report on Groundwater Flow Modelling Study of the Love Canal Area, New York), is an imaginative attempt to make the most out of an inadequate data base. We would strongly urge that all of the eight recommendations (pp. 1-5, 1-6) be adopted. We agree with GeoTrans Inc. that an effective groundwater model is a very valuable tool in analyzing a site such as Love Canal, and that in order to get a good understanding of the site, the drilling, monitoring and modelling phases are iterative and require at least 3 months for each cycle of phases. We recognize that the study was carried out under severe time constraints and believe that the amount of work which was carried out in that timeframe was impressive and useful. However, we feel that conclusions have been drawn based on short-term studies that far outstretch the ability of the science to support. Indeed, GeoTrans Inc. suggests that a good rule of thumb in the business of predictive simulations is "predict with confidence for one-half the period of the historical match". In the example at hand, confidence in the conclusions can only apply over a very short period of time.

The GeoTrans Inc. conclusions sound relatively reassuring, i.e. contamination from Love Canal is restricted to the shallow system of surficial deposits and this contamination will likely be recovered by the French Drain system in future years, but their analysis is based on limited data. We are aware that Mr. Twedell of JRB Associates, who provided this data, has had his capabilities called into question.

We feel that the data base is insufficient to predict trends with confidence. For example, while the data can perhaps be used to conclude that there is in general no significant contribution from Love Canal to the bedrock aquifer, the same data can be used to indicate that for one compound at least (3-chlorotoluene), there may be a contribution to the Upper Niagara River because while the compound is not found "upstream" of Love Canal, it is found in "downstream" groundwaters in concentrations ranging between 13 ug/L and 62 ug/L.

In summary, the data base does not provide the necessary confidence to conclude one way or the other, that contaminants from Love Canal are not migrating through the bedrock aquifer to the Niagara River now, or will not do so in the future.

Bedrock Contamination - On the other hand, there does seem to be enough evidence to support EPA's conclusion that "low level widespread contamination" was observed throughout the bedrock aquifer.

This conclusion is especially worrisome when coupled with our calculations (based on limited data) indicating a flow of approximately 24,000 litres per day of groundwater through the upper, more permeable, five metres of the Lockport Dolomite and passing beneath the site. GeoTrans Inc. puts a minimum travel time on this pathway, of 12 years from the site to the Niagara River in a worst case analysis of how fast wastes might travel.

The reference in the EPA report to sand lenses in the site and the comparatively short distance between the base of the canal and the Dolomite (estimated to be in the order of 15-25 feet) does not provide us with confidence in concluding that the long range isolation of the site can be assured, even taking into account the proposed peripheral containment measures being planned for the overburden above the bedrock.

II OTHER PATHWAYS

Q. Are we satisfied that other pathways such as transport of toxics by air and the re-mobilization of contaminated sediments in storm sewers and creeks in the area are not, nor will they in the future, affect the environment of Canadians?

A. We agree with the report's opinion that the data on contaminants in air is not particularly reliable in terms of analytical procedures and statistical interpretation, for a number of reasons discussed in the report. While we are inclined to accept that Love Canal does not represent a significant source of air contaminants to Canadians, we would prefer to see a more thorough assessment, including estimates of mass flux from the site.

Storm sewers and creeks in the Love Canal area however, are clearly a matter of concern. They are contaminated by high levels of many organic chemicals including dioxin and are indicative of Love Canal being a past source of contaminants to the Niagara River. Until evidence of clean-up activity is seen, we cannot conclude that the storm sewers and creeks will not continue to contaminate the Niagara River.

Discussion

Air - The air monitoring section of the Love Canal report is not totally useful if one is attempting to look at it in terms of assessing transport of contaminants from the site to any point. We recognize that an important objective of the study was to analyze indoor air in the Love Canal area and that monitoring was directed to this purpose.

We feel however, that much more accurate and effective information could have been acquired with much less effort if some of the trace gas analysis equipment (e.g. TAGA) available in 1980 had been used.

We would suggest that such an approach be employed, with the objective of estimating mass flux of chemicals of concern from the area.

Storm Sewers and Creeks - We recognize the problems of assessing the source of contaminants in sediments in the Niagara River in the vicinity of the 102nd Street outfall. This is of course on account of the close proximity to the 102nd Street landfill. While we understand the reasons that the Love Canal report states that "it cannot be concluded unequivocally that the source of contamination is Love Canal", we would refer to work by Elder, Proctor and Hites (Environ. Sci. Tech., Vol. 15, pp. 1237-1243, 1981) which indicates that benzyl chloride and benzoyl chloride waste derivatives may be effective tracers for discriminating between the Love Canal and 102nd Street sources.

We find that limited (one site) sampling was carried out on stream sediments in Cayuga Creek, which accepts flows from both Black and Bergholtz Creeks. Given the fairly high (42 ppb ~~X~~-BHC) contamination at this one location in Cayuga Creek, and taking into account data recently (October, 1981) produced by Dr. Stalling of the U.S. Fish and Wildlife Service, which finds dioxin levels of 417 ppt in carp collected at the mouth of Cayuga Creek, we suggest that further investigations of stream sediment in Cayuga Creek would be wise. [The Ontario Ministry of the Environment has also tested fish (spot-tailed shiners) found at the mouth of Cayuga Creek in 1981 and found PCB (573 ppb), DDT (23 ppb), Mirex (18 ppb), and TCDD (59 ppt). Certainly the data clearly indicate that Black and Bergholtz Creeks are highly contaminated and should be carefully cleaned up. This clean-up should not be allowed to re-mobilize and permit the entry of contaminated sediments into the Niagara River.]

III DATA AND ANALYSIS

Q. Are we satisfied that the scientific information and technical conclusions provided in the Love Canal reports are in fact based on adequate scientific data and analysis and does the report give us the information we need to answer the first two questions?

A. Given the short time during which this study was planned and carried out, there is a very large amount of useful data which the Love Canal report has provided. However, the type and quantity of the data base and the resulting analyses are not sufficient to satisfy Environment Canada that Love Canal is not now, and will not in the future be a source of contamination of persistent toxic substances to the Niagara River.

Discussion

Quality Assurance/Quality Control (QA/QC) and Analytical Methods - It should first be pointed out that our review did not include GCA reports Love Canal Monitoring Program, QA/QC Summary Report, or Quality Assurance Plan, Love Canal Study, because they have not been made available to us as yet. From our study of the Environmental Monitoring at Love Canal report however, we have been reasonably impressed with the QA/QC program carried out and recognize the acknowledgement of the constraints enumerated on page 41 of the report.

The QA/QC program has been extensive enough to be able to show a large variation in the quality of data provided by the numerous analytical labs participating. Not having had access to referenced GCA reports on QA/QC, we do not know if the QA/QC program covered sampling procedures and we feel that aspects of the hydrogeological program may have been particularly vulnerable. An example would be the procedures for soil sampling in which as many as five cores six feet long were combined, homogenized and then analyzed. We are concerned about volatilization of organics during this procedure and also dilution in the sample resulting in artificially low residue levels.

The analytical methods used combined with the problems of Quality Assurance/Quality Control among a large number of labs analyzing for compounds other than TCDD give rise to probable errors which, while difficult to quantify, could be significant. This calls into question, for example, the results concerning non-detectability. Consideration of the limits of detection and large variation (30-100%) in analytical recoveries should have been used in drawing conclusions.

We wonder whether the fact that a large proportion of the organic analyses were for volatile compounds, that had in some cases been stored for many weeks, may have also contributed to the findings of non-detection.

Data Base, Controls and Statistics - One of the main conclusions that the Love Canal report draws is that there is no significant difference in levels of contaminants between sampling sites in the Declaration Zone of the Love Canal area and other places in the Niagara Falls area. While our review has been approached from the point of view of seeking direct assurance, now and in the future, that the site will not impact upon the Niagara River, we feel that the small number of control samples makes invalid the statistical conclusion that Love Canal is no different, i.e. the null hypothesis. We feel that there is an inadequate data base of non-volatile persistent organic compounds and we suggest that chlorophenols should have been looked for more extensively and more TCDD and PCB analyses would have been useful. We would also suggest doing polychlorinated dibenzofuran (PCDF) analyses in the Love Canal area based on the prevalence of PCB's and the presence of PCDF's in Cayuga Creek (Stalling, U.S. Fish and Wildlife Service).

The large number of "non-detectables" referred to in the previous section on QA/QC, in both the Love Canal and control samples, together with a very small number of controls, makes it impossible to prove the null hypothesis. The data base provided is useful to begin to draw conclusions about what is happening in and around the Love Canal site and to plan further investigation, but it is only a picture at a point in time and not sufficient to draw conclusions with confidence.