

THE ASSEMBLY  
STATE OF NEW YORK

**THE FEDERAL CONNECTION:  
A History of U.S. Military  
Involvement in the Toxic  
Contamination of Love Canal  
and the Niagara Frontier Region**

January 29, 1981

An Interim Report  
to New York  
State Assembly Speaker,  
Stanley Fink

New York State Assembly  
Task Force on Toxic  
Substances

VOLUME I

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## SUMMARY OF FINDINGS AND RECOMMENDATIONS

### FINDINGS

On the basis of this Interim Report, documenting its investigation to date, the Task Force on Toxic Substances issues the following findings:

#### LOVE CANAL

FINDINGS I. THE DISPOSAL OF TOXIC CHEMICAL WASTES FROM ARMY AND GOVERNMENT-RELATED CHEMICAL PRODUCTION IN THE NIAGARA FALLS REGION CONTRIBUTED SIGNIFICANTLY TO THE TOXIC CONTAMINATION OF LOVE CANAL

Eyewitness evidence reviewed by the Task Force establishes conclusively that Army personnel openly, concerted and repeatedly disposed of drummed materials at Love Canal in Niagara Falls, New York during the nineteen forties and early nineteen fifties. As of the date of this Report, thirteen individuals have stated, either in interviews, affidavits or sworn testimony, that they witnessed Army personnel dumping drums at Love Canal or recalled military disposal-type activities in the area.

The Task Force strongly suspects that there are numerous eyewitnesses to Army dumping who have not yet been identified or interviewed. Despite its intensive review of military activities in the Niagara Frontier Region, the Task Force was unable to determine the origin and mission of the Army personnel sighted at Love Canal. Documents obtained by the Task Force detailing World War II-era military practices and procedures with regard to the disposition of toxic materials are consistent in most respects

with the descriptions provided by eyewitnesses of Army disposal activities at Love Canal. The Task Force's conclusion that Army personnel were directly involved on numerous occasions with the dumping of wastes at Love Canal may be contrasted with the Defense Department's steadfast denials of such involvement, and of any legal liability or responsibility for damages or injuries arising from the disposal of hazardous wastes at Love Canal. The Task Force investigation also produced evidence that the extent of Federal involvement was not limited to instances of direct dumping by Army personnel at Love Canal. Substantial quantities of chemical and hazardous wastes generated at various government-owned or government-equipped facilities were also disposed of at Love Canal, ostensibly by private civilian contractors. These facilities included, among others, the Niagara Falls Army Chemical Plant and two plants operated by Hooker Electrochemical Company for the manufacture of thionyl chloride and dodecyl mercaptan. The Federal Government, which employed and supervised these contractors, and was the primary if not exclusive user of the products manufactured, is responsible for the consequences arising from the disposal of wastes from the plants.

FINDING II. THE ARMY'S 1978 INVESTIGATION AND REPORT  
DID NOT ADEQUATELY EXAMINE THE ISSUE OF ARMY  
INVOLVEMENT AT LOVE CANAL

The Army's 1978 investigation and report concerning allegations of Army involvement in dumping at Love Canal, which found no evidence of "direct Army involvement" in dumping, was materially deficient and inaccurate in substantial respects. The

Army's investigation was hampered by the imposition of an unreasonable deadline and the overly restrictive scope for the inquiry set by the Department of Defense. Consequently, important government records were overlooked or misread, known witnesses were ignored and additional eyewitnesses were not sought out. Ultimately, the Army investigators were unable to either substantiate or discredit the eyewitness allegations. Nevertheless, their findings were used as evidence of the lack of Army involvement in dumping at Love Canal. Because of the defects in its methodology and execution, the Army investigation did not adequately explore the question of Army involvement at Love Canal.

#### MANHATTAN PROJECT LEGACY

FINDING III. THE ARMY'S "MANHATTAN PROJECT" DISPOSED OF 37 MILLION GALLONS OF RADIOACTIVELY CONTAMINATED CHEMICAL WASTES IN UNDERGROUND WELLS WHICH THE FEDERAL GOVERNMENT HAS TO DATE NEITHER MONITORED NOR IDENTIFIED IN ANY OF ITS SURVEYS.

In the 1944-1946 period, with the explicit approval and knowledge of Army officials, Linde Air Products, then a Manhattan Project contractor, disposed of over 37 million gallons of radioactively contaminated liquid chemical wastes in shallow underground wells located beneath the Linde property. These liquid wastes, which were highly caustic, emanated from the first stage of the uranium ore refining processing at the Linde Plant. Both the Army and Linde were well aware that this method of disposal would further contaminate Linde's wells and the wells of

Linde's neighbors in the surrounding region. The documents evidence that this method of disposal was selected precisely because the source of underground contamination could not readily be traced back to Linde or the Army.

The present environmental impact of the chemical and radioactive contamination caused by the disposal of liquid wastes from the Linde Plant cannot be assessed by the Task Force. The caustic effluent, containing only a relatively small proportion of uranium oxide, may have been sufficiently diluted underground so that it does not today pose a health hazard. Most disturbing is the fact that both the Army and the Department of Energy, despite their much vaunted "remedial action programs" and the completion of numerous federal studies and surveys in the Region, have failed to identify the location of the wells or indicate knowledge of their use by MED and Linde. No analysis or monitoring of the Linde wells or of related chemical contamination in the surrounding ground and well water is known to have been conducted to date.

FINDING IV.      CIVILIAN WORKERS AT VARIOUS MANHATTAN PROJECT AND ATOMIC ENERGY COMMISSION PLANTS IN THE NIAGARA FRONTIER REGION WERE, DUE TO PRIMITIVE FEDERAL STANDARDS AND INADEQUATE PROTECTION, EXPOSED TO EXCESSIVE LEVELS OF RADIATION.

Documents obtained from the Department of Energy through the Freedom of Information Act evidence that numerous plant workers at various Manhattan Project and Atomic Energy Commission operations in the Niagara Frontier Region were exposed to excessive levels of radiation. In many cases, the workers were

not fully aware of the hazards involved with the radioactive substances with which they were dealing, in part due to the secrecy of the projects, in part because research on long-term radiation effects had not been carried out on humans. In the 1940's especially, radiation effects were judged largely on the basis of immediate toxicity, not on the basis of latent, long-term effects. Accordingly, while exposure of workers in government plants to large, sudden doses were avoided, less emphasis was placed on preventing extended exposure to low-level radiation. The documents reviewed by the Task Force indicate that many workers were exposed to radiation exceeding even the primitive standards of the time. During one period, the permissible exposure limits were in fact raised in order to spur production for the war effort.

The men and women who worked at Linde Air Products and Electrometallurgical Co. and later at Lake Ontario Ordnance Works, Simonds Saw and Steel, Bethlehem Steel and other locations have, so far as the Task Force could determine, not been the subject of any follow-up health studies by any agencies of the Federal Government. Such a study is clearly called for since the latent effect of over-exposure to radiation may be manifesting itself today amongst these workers.

#### THE LAKE ONTARIO ORDNANCE WORKS

##### FINDING V.

THE ARMY TNT PLANT AT LOOW WAS NEVER SUFFICIENTLY DECONTAMINATED, LEAVING AN UNCHARTED LEGACY OF TNT WASTES AND RESIDUES IN AN AREA NOW OCCUPIED BY A CHEMICAL WASTE LANDFILL AND TREATMENT FACILITY.

The wartime operation by Army Ordnance of a TNT plant at the Lake Ontario Ordnance Works ("LOOW"), a 7500 acre plot located in



the Towns of Porter and Lewiston in western New York, eight miles north of Love Canal, resulted in the contamination of part of the plant's surface area and a vast network of underground waste lines with TNT wastes and residues. According to government documents obtained in the course of the Task Force's inquiry, neither the areas above or below-ground were ever fully decontaminated by the Army when the property was declared surplus. Ultimately, after a series of government uses, the site on which the TNT plant once stood was conveyed to private individuals by the Federal Government's General Services Administration, who provided no notice to the new owners of the existing contamination hidden on the site. GSA officials were themselves apparently oblivious to the presence of residual TNT contamination on the site, despite records in the government's own files explicitly documenting this condition.

The Army's legacy of TNT contamination at the site is significant today because of the potential dangers arising from any TNT residues that may remain in the waste lines. Particularly in light of the site's present use by SCA Chemical Waste Services, Inc. as a chemical waste treatment and disposal facility, even the slightest possibility of explosions or fire from hidden TNT or residual wastes is of grave concern.

FINDING VI.      THE USE OF PART OF THE ILL-SUITED LAKE  
ONTARIO ORDNANCE WORKS SITE BY THE DEPARTMENT  
OF ENERGY AND ITS PREDECESSORS HAS RESULTED  
IN SIGNIFICANT RADIOACTIVE CONTAMINATION ON  
AND OFF THE FEDERALLY-OWNED SITE.

The use of part of the former Lake Ontario Ordnance Works site as a storage and disposal center for radioactive materials

and wastes from the Manhattan Project and subsequent atomic research and weapons production programs has created a continuing environmental hazard over the past thirty years. Radioactive materials buried and stored at the site have been migrating off the site through the air and through the surface drainage system. Currently the subject of a federal "remedial action" plan, there have been repeated surveys and studies of the LOOW, although the precise extent of the contamination on and off the site is yet to be fully determined.

Documentary evidence compiled by the Task Force discloses that in some instances conditions at the site were created and even fostered by injudicious federal policies. Federal mismanagement at the site was manifested by sloppy and deficient record-keeping procedures, inadequate mapping of buried wastes, and technological primitivism with regard to waste storage and disposal. Moreover, it is clear that the site should never have been chosen for the storage of radioactive materials in the first place. In light of its poor drainage and significant levels of precipitation, it was singularly ill-suited for this function. Federal officials were aware of these considerations when initiating use of the site, but ignored them. An AEC official was later to recollect that the choice of the LOOW site hinged more on availability rather than on any unique features making it suitable for such storage. Expediency and economy were the principal determinants of the federal storage program, a program that included, among other things, the dumping of radioactive wastes in open and often unmapped pits, in rusting barrels

stacked along the roadside, and in inadequate structures originally designed for different purposes. Inevitably, these practices and others resulted in the contamination of the LOOW site and in the leaching of radioactive contaminants off the site onto land outside the control of the Federal Government.

Compounding the problem was the lack of information concerning the LOOW provided to local and state health and environmental officials and to the public. Government documents reveal that on several occasions, federal officials misled local government representatives and the public concerning the nature of federal activity at the site and the extent of the radiological hazard at LOOW. The result of this deception was to discourage local and state oversight of federal activities at LOOW and to delay the necessary state actions later taken to protect the neighboring community from government-induced contamination.

FINDINGS VII. IN 1954-1955, THE ATOMIC ENERGY COMMISSION PERMITTED CARBORUNDUM METALS CO. TO DUMP THOUSANDS OF GALLONS OF UNTREATED THIOCYANATE WASTES DIRECTLY INTO THE NIAGARA RIVER THROUGH THE OUTFALL SEWERS AT THE LAKE ONTARIO ORDNANCE WORKS.

Government documents obtained by the Task Force evidence that top-level AEC officials explicitly sanctioned the undercover disposal by a private contractor of thousands, possibly millions of gallons of untreated thiocyanate wastes through the LOOW outfall sewers. The waste, generated by an AEC contractor, Carborundum Metals Co. and dumped free of charge, was carried by the LOOW sewer to the Niagara River and ultimately to Lake Ontario. The disposal operation was carried out with the

conditional approval of the New York State Department of Health. However, there is no indication that the conditions set forth by the Health Department were met. The disposal operation began as emergency measure but continued for over a year, as the contractor made no alternate provisions for disposal despite his promise to do so. No record of this disposal operation was provided to the Interagency Task Force on Hazardous Wastes during their 1979 review.

### RECOMMENDATIONS

With regard to the above findings, the Task Force on Toxic Substances respectfully submits the following recommendations:

#### LOVE CANAL

a) The New York Congressional delegation should sponsor legislation providing additional federal funds for the Love Canal remedial program, and for comprehensive health studies for those individuals whose physical and mental health may have been affected by chemical contamination at Love Canal.

b) The Department of Defense should reopen its investigation into military involvement in the contamination of Love Canal. The intensified investigation should continue until the identity and source of the Army personnel seen dumping drums at Love Canal is established or all possible avenues of investigation are exhausted.

c) The supporting documentation to this Interim Report should be made available to the Attorney General of the State of New York in order that he may assess whether the Federal

Government's direct and indirect contribution to the contamination of Love Canal warrants the commencement of state legal action.

#### LINDE WELLS

a) The Departments of Energy and Defense and the Environmental Protection Agency should conduct a study of the impact of the disposal of radioactively contaminated chemical wastes in underground wells located on the property of Linde Air Products in Tonawanda, New York. Remedial action, if necessary, should be undertaken without delay.

b) The Office of Environmental Compliance and Overview of the Department of Energy ("DOE") should commence an internal inquiry to discover and eliminate the flaws in DOE's Formerly Utilized Sites Remedial Action Program which permitted the Linde Wells disposal site to escape identification.

c) State and local environmental officials in the states in which former Department of Energy, Atomic Energy Commission and Manhattan Project facilities were situated should independently examine the history of operations at those facilities, and scrutinize the federal remedial action programs, if any, ongoing in their state.

d) The Department of Energy and the Department of Health and Human Services should initiate a comprehensive study to determine the long-term health effects of excessive exposure to radiation on workers at Federal Government facilities in the Niagara Frontier Region.

e) The New York State Department of Health should review the documentation collected by the Task Force in order to determine whether there is an imminent or serious health risk to workers who received excessive exposure to radiation. If such a risk is presented, these former workers should be immediately notified and examined.

f) The Federal Government should provide the New York State Department of Health with funds adequate to conduct the studies recommended above.

#### LAKE ONTARIO ORDNANCE WORKS-

a) Any new construction and excavation by SCA Chemical Waste Service, Inc. in the areas described by government documents as contaminated should be suspended until a definitive determination is made as to the present hazards posed by residual TNT contamination.

b) The Department of Defense and the Environmental Protection Agency should perform an extensive survey of the on and off-site contamination at the Lake Ontario Ordnance Works. The condition of the underground waste disposal lines at the plant should be carefully examined, particularly in light of the site's present and expanding use by SCA and the likelihood of additional excavation and construction at the site in the future. The New York State Department of Environmental Conservation, which licenses the SCA site, should oversee the federal survey of the site and independently evaluate its findings.

c) In light of a history of mismanagement and neglect on the part of the Department of Energy and its predecessors, the

present use of a portion of the LOOW site (now designated the Niagara Falls Storage Site) for the storage and disposal of radioactive materials and wastes should be discontinued. Accordingly, the Department of Energy should initiate forthwith the full decontamination and decommissioning of the site.

d) The New York Congressional delegation should further the enactment of a recently introduced Senate bill, S.2980. This legislation would require that Department of Energy radioactive waste sites be licensed by the Nuclear Regulatory Commission ("NRC") as are similar waste operations in private industry. The bill would provide an initial five-year program in which the NRC would regulate five to ten Department of Energy sites. In light of its troubled history, the Niagara Falls Storage Site should be selected as one of the sites to be regulated.

## INTRODUCTION

The Federal Government's legacy of contamination on the Niagara Frontier is not a proud story to recount. This Interim Report, reflecting the findings of an investigation begun over fifteen months ago, chronicles an incredible, occasionally surreal, history of federal mismanagement, exploitation and despoliation of widespread sections of one of the most beautiful and productive regions of New York State.

The original focus of the Task Force inquiry was primarily on the eyewitness allegations of United States Army dumping of toxic wastes into Love Canal, and the sufficiency of the Army's 1978 investigation into those allegations. Exploration of these questions, and determination of the possible sources of the Army personnel sighted, necessarily required a comprehensive review of Federal Government defense-related activities in the Niagara-Erie County Region. The scope of the inquiry expanded radically as it became apparent that Love Canal and federal involvement there was merely the proverbial "tip of the iceberg".

In the course of its investigation, the Task Force discovered that several federal monuments to environmental folly remain in the Niagara and Erie County region -- some already a matter of public knowledge and a subject of remedial efforts, and some, shockingly, unknown, and unmonitored. How these sites, born in the crisis of war, were conceived, utilized, and then abandoned is the story told by this Report.



The toxic contamination of Love Canal, the transformation of the Lake Ontario Ordnance Works site into a perpetual wasteland, and the dotting of the Niagara Frontier Region landscape with areas of excessive low level radiation are not new revelations. However, the documents obtained by the Task Force and discussed in this Report cast new light and provide a fresh perspective on the origins, operations and potential hazards of the federal enclaves formerly and presently located in the Niagara Frontier Region. The activities of the Federal Government in the Region have indeed proven a mixed blessing. After contributing to the success of the war effort, many of the chemical manufacturing and uranium processing facilities constructed by the government during the war were converted to post-war civilian use, spurring industrial growth throughout the Region. The price exacted for wartime success and post-war expansion was a heavy one, however. The deleterious impact of the chemical and radioactive contamination left behind by military and government agencies, and the potential health injuries suffered by workers overexposed to radioactive elements at government plants are just now becoming known.

Described in this Report are environmental crimes that leave no single, readily identifiable villain to indict. Primitive technology, budget limitations, bureaucratic ineptitude and indifference, the triumph of sheer expediency over foresightedness -- these are the recurring and dominant themes that mark this saga. The principal actors throughout, various agencies of the Federal Government, frequently operated under a

shroud of secrecy, successfully avoiding oversight by both state and local governments. These agencies did not always act alone, however. Acting in complicity with the Federal Government were various members of private industry, who despite their superior technical expertise frequently advised and knowingly participated in the commission of environmentally unsound practices. The role of private industry in this regard can be neither minimized nor excused. Equally disturbing is the fact that state and local governmental agencies, charged with the responsibility of regulating federal activity, were sometimes aware of improper federal practices, yet turned their backs. In other instances, state and local government officials were prevented from fulfilling their responsibilities, as when they were deceived, misled or simply not informed of the functions, activities and disposal methods employed at the various federal sites.

The discussion in this Report illustrates that serious errors in judgment and policy were made by Federal Government officials, frequently it seemed, as the result of a hasty, ill-informed, or uncaring decision-making process. These mistakes, unfortunately, cannot magically be undone. The first step is simply to recognize that errors were made. The second is to accurately assess the present state of chemical and radioactive contamination in the Region and, where unremediable, to make just reparations to those who must live with its impact.

One objective of this State Legislative Report is to force the Federal Government to take the initiative in addressing the impact of its past activities. The identification and clean-up

of formerly utilized government sites, and the pollution that they have caused, is the legal, moral and financial responsibility of federal, not state government. The recent enactment of the "superfund" legislation may provide one source of funds for cleaning up the residue from war and post-war federal activity. The \$15 million dollar combination loan and grant from the Federal Government for the relocation of some Love Canal residents is an additional welcome step. But much more remains to be done. The responsible federal agencies, the Departments of Defense and Energy, must themselves assume the task of investigating their part in the toxic contamination of the Niagara Frontier and the formulation and execution of effective remedial programs.

Looming in the background is an equally significant issue -- what other sites within New York State and throughout the country have similarly evaded detection and remediation by the Federal Government? There is much evidence to suggest that a serious nationwide problem exists. The hazards presented are not theoretical; environmental contamination from TNT production wastes, unexploded and undiscovered munitions and buried radioactive wastes all pose a clear and present danger to our society. Throughout the United States, the Federal Government has owned, operated, or sponsored many facilities involved in nuclear energy research, chemical manufacturing and weapons production. The long-term effects of those projects are only now being manifested and must be closely scrutinized.

Today, threats to a fragile environment are presented by the installation of complex weapons systems within our borders and abroad. As the accident at Three Mile Island and the Titan missile explosion have demonstrated, the potential for human disaster lurks close by. Federal enclaves located within the various states deeply affect the regions in which they are located. They cannot operate as islands unto themselves. The present and future architects of national policy must be willing to balance competing, but not irreconcilable forces. It is to be hoped that, unlike their predecessors, they will not succumb to expediency and ignorance, rationalizing the defense of our freedom as sufficient justification for the pollution of the very land in which we, and succeeding generations must live.

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GLOSSARY OF FREQUENTLY USED  
NAMES, TERMS AND ABBREVIATIONS

AEC	U.S. Atomic Energy Commission
CWS	Chemical Warfare Service, U.S. Army, later known as "Chemical Corps"
Committee On Environmental Conservation	A Standing Committee of the New York State Assembly; the parent organization for the Task Force on Toxic Substances
DDM	Dodecyl mercaptan, a chemical manufactured by Hooker for the RFC
DOE	U.S. Department for Energy
EPA	U.S. Environmental Protection Agency
FUSRAP	Formerly Utilized MED/AEC Sites Remedial Action Program
GSA	U.S. General Services Administration
Griffin Manor	Former federal housing project located close to Love Canal
Impregnite	Chemical substance manufactured at the NFCWP
Interagency Task Force on Hazardous Wastes	Task Force composed of officials from federal government and state Health and Environmental Conservation departments
LOOW	Lake Ontario Ordnance Works
LOSA	Lake Ontario Storage Area
MED	Manhattan Engineering District (Corps of Engineers division responsible for Manhattan Project)
NFCWP	Niagara Falls Chemical Warfare Plant

NFSS	Niagara Falls Storage Site (present DOE facility at LOOW)
Niagara Frontier Region	Niagara County and Erie County
P-45	Code name for facility and product made by Hooker for MED
RFC	Reconstruction Finance Corporation
THAMA	U.S. Army Toxic and Hazardous Materials Agency
Thionyl Chloride	Chemical manufactured by Hooker for CWS
WAA	War Assets Administration

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The Task Force also wishes to acknowledge the efforts of staff members of the Ecumenical Task Force in Niagara Falls, whose assistance greatly facilitated the investigation. In addition, the Task Force would like to thank the officials and employees of various federal agencies, including the National Archives, Department of the Army, Department of Energy and the General Services Administration for their aid in locating many of the research and documentary materials cited in the Report.



## ORGANIZATION OF REPORT

This Interim Report is structured in four sections. The introductory section provides background information concerning the nature, scope and progression of the Task Force investigation, and a brief historical overview of the origins of Love Canal and the breadth of significant federal activity in the Niagara Frontier Region.

Following this section is a discussion of the Task Force's seven findings, which are organized into related subject areas. Part One (Findings I and II) considers the question of Army and federal responsibility for the toxic contamination of Love Canal. Eyewitness evidence of Army dumping at the Canal is analyzed and the possible Federal Government-related sources for the chemical wastes dumped at Love Canal in the 1940s and early 1950s are detailed. In this context, the sufficiency of the Army's 1978 investigation into allegations of Army dumping at Love Canal is explored.

Part Two (Findings III and IV) of the Report examines two subjects which reflect the continuing impact of Manhattan Project activities in the Niagara Falls Region -- the disposal of 37 million gallons of liquid radioactive wastes in underground wells and the potential long-term health impact of worker exposure to excessive levels of radiation at various Manhattan Project plants in Western New York.

The use and misuse of the former Lake Ontario Ordnance Works ("LOOW") site is the subject of Part Three (Findings V, VI and VII) of the Report. First explored is the contamination of a

portion of the LOOW with TNT wastes and residues and the failure of the Federal Government to fully decontaminate the site prior to its disposal to the public. In the succeeding section, the subsequent use of a portion of the LOOW as a disposal and storage center for radioactive wastes and materials and the consistent mismanagement of the site by various federal agencies is examined. Lastly, an example of one of the waste disposal methods practiced at the LOOW, the dumping of thousands of gallons of thiocyanate wastes directly into the Niagara River, is described.

## I. HISTORY OF TASK FORCE INVESTIGATION

The discussion which follows, describing the origin, evolution and methodology of the Task Force's investigation, is intended to place in perspective the nature of its inquiry, and the research sources utilized in developing the findings and conclusions made herein.

### A. Phase One -- Commencement of Investigation and Issuance of a Preliminary Report

On June 1, 1979, New York State Assembly Speaker Stanley Fink directed that a legislative inquiry be commenced concerning what was soon to become one of the most controversial and distressing issues confronting the Legislature and the people of New York State: the crisis created by toxic and hazardous waste contamination at Love Canal. Since at that time federal and state lawsuits with regard to Love Canal had not been commenced against Hooker Chemicals & Plastics Corp. ("Hooker"), the Assembly's investigation focused on the broad question of responsibility for the Love Canal disaster, the marshalling of all available facts regarding ownership and use of the Canal, and the nature of the environmental threat presented.

The checkered history of the development and use of Love Canal unfolded gradually through interviews and document searches by the Assembly's investigative consultant. Hooker, it

was clear, was the primary contributor of the chemical wastes dumped at Love Canal. However, it was equally clear, particularly in light of the documents which had been unearthed, that the allegations made in 1978 by two Niagara Falls residents of wartime military dumping at Love Canal<sup>1</sup> had never been satisfactorily resolved, even by the formal Army investigation and Report<sup>2</sup> completed in August 1978. The more closely it was scrutinized, the more it became apparent that the cryptic Army report truly raised more questions than it answered.<sup>3</sup>

As additional information and documentation were collected concerning federal wartime activity in the Niagara County area, one puzzling question remained unanswered. The documents revealed that the Army Ordnance Department, the Chemical Warfare Service and the Manhattan Project were all heavily involved in chemical production and uranium processing in the region. What, then, had become of the chemical and radioactive wastes these projects necessarily had produced? The statements of the eyewitnesses alleging direct Army dumping at Love Canal suggested a likely depository, but by their very nature could not establish to a reasonable degree of certainty the source, contents or quantities of the materials being disposed. The government documents then being reviewed were indeed provocative. While unsurprisingly silent about Army disposal activities at Love Canal, they evidenced a distressing pattern of careless and unremedied contamination throughout the Niagara Frontier (Niagara and Erie Counties) Region [See Figure 1].

The initial findings of the Assembly's investigation were summarized in a "Preliminary Report" dated May 29, 1980, submitted by the four-member<sup>4</sup> Task Force on Toxic Substances ("Task Force") which had been specially appointed by Speaker Stanley Fink. The Task Force Report concluded:

- i) that the Federal Government was engaged in extensive wartime and post-wartime production of chemicals and munitions in the Love Canal region;
- ii) that the Federal Government improperly disposed of chemical wastes from these projects; and
- iii) that the Federal Government had transferred to private concerns<sup>5</sup> property which had been used in wartime projects which was dangerously contaminated and had not been adequately decontaminated.<sup>6</sup>

Responding to the serious though unsettled issues raised by the Preliminary Report, Speaker Fink, at the Task Force's urging, authorized the New York State Assembly Standing Committee on Environmental Conservation (the Task Force's parent body) to conduct formal hearings, with full subpoena power, to further explore the question of federal involvement. Thus, the investigation entered its second stage.

B. Phase Two -- Along the Paper Trail

The Task Force's Preliminary Report engendered some predictable, as well as some constructive responses. The Department of Defense repeated its previous denial of involvement, asserting that the Army had no "program" of dumping wastes into Love Canal, or elsewhere in the region.<sup>7</sup>

Three days after the issuance of the Preliminary Report, the office of the New York State Attorney General, which had by this time commenced a lawsuit against Hooker for damages in excess of

600 million dollars, filed a Freedom of Information Act request with the Department of Energy and the National Archives, requesting all documents relating to the Preliminary Report. Most significantly, the publicity accompanying the Report focused public attention on the issue. Angered by the Army's blanket denial of involvement at Love Canal a Niagara Falls resident, Alfred Jones, publicly stated that he too had witnessed Army dumping at Love Canal on a hot summer day in 1942. "I damn well saw them down there", Jones reportedly stated.<sup>8</sup>

Closely following the issuance of the Report, Mrs. Lucinda McCombs, a former Niagara Falls resident, appeared on a local television station and vividly recounted a 1942 incident involving Army personnel disposing of drums at Love Canal. Although a local newspaper commented in an editorial that the Preliminary Report contained "really nothing much new" linking the Army to Love Canal, it nevertheless called for reopening the inquiry into Army involvement and criticized the Department of Defense for so readily dismissing the eyewitness accounts of area residents. State and federal governments were urged to take the necessary action to resolve the question.<sup>9</sup>

Recognizing the complicated factual and legal nature of the questions involved, and the difficulties inherent in investigating long-forgotten events whose only trace by now rested in distant memories and dusty archives, the Task Force staff was expanded significantly. Its defined objective, at least, was straight-forward -- to resolve, finally and responsibly, the long-standing allegations of Army dumping at

Love Canal. The purpose of the Task Force's inquiry was not to absolve or to lessen the responsibility of Hooker or other members of private industry for their activities at Love Canal, but simply to insure that all the relevant facts became known.

Achieving this end required the utilization of three basic research and information sources:

- i) Government documents from archives and record centers, which would detail the nature of the military-related chemical production and waste disposal activities which took place in the Niagara Frontier region;
- ii) Former Love Canal area residents who could recall incidents of Army dumping with sufficient credibility and clarity so as to establish to a reasonable degree of certainty the occurrence of these activities;
- iii) The documentary record compiled by the Army during the course of its 1978 investigation.

#### 1. Document Search and Review

The question of military toxic contamination of the Niagara Frontier was by no means virgin territory. Two years prior to the Task Force's inquiry, the Army had, in response to eyewitness allegations of Army dumping at Love Canal, conducted a three-week investigation surveying Army-related chemical activities in the Niagara County region. The investigation produced a controversial 22-page narrative, dated July 27, 1978, (known as the "Board of Officers Report") which detailed the investigation's history, methodology and findings. A summary version of this Report, tailored for public release, was also prepared and submitted to the state and federal officials who had requested the investigation ("August 14 Report").<sup>10</sup>

Not long after its Love Canal investigation was completed, the Army's Toxic and Hazardous Materials Agency ("THAMA"), at the request of the Federal Environmental Protection Agency ("EPA"), prepared a study, dated January 1979, entitled "New York Contamination Survey." This report, which was later incorporated in the Interagency Task Force Report, discussed infra, purported to inventory all Army operations in Niagara and Erie Counties in the past 50 years which might have generated or disposed of hazardous waste. This review did not include Air Force, Navy, Atomic Energy Commission ("AEC") or Manhattan Engineer District ("MED") activities in the Region, which were later separately reviewed and reported to the EPA by the agencies involved.

The Department of Energy ("DOE"), together with its predecessor agencies, MED and AEC, had in the past conducted numerous radiological surveys at the former Lake Ontario Ordnance site,<sup>11</sup> at two radioactive waste disposal sites in Erie County,<sup>12</sup> and at various anomalous radiation hot-spots in the surrounding region.<sup>13</sup> Moreover, the problem of radioactive contamination from former MED or AEC sites was hardly limited to the Niagara Frontier. Former sites have for the past several years been the subject of DOE's "Formerly Utilized Sites Remedial Action Program" ("FUSRAP"). The FUSRAP program was initiated in 1974 to identify and evaluate the radiological status of formerly utilized MED or AEC sites which had become contaminated and which might not have been acceptably decontaminated. DOE has admitted that contamination at these sites resulted from "the urgency and magnitude of [the] early nuclear energy program and to the limited experience and knowledge available regarding the



radioactive characteristics of residual materials."<sup>14</sup> An October 1979 DOE report ("FUSRAP Report") described the radiological status at MED and AEC sites in 24 states and the District of Columbia.<sup>15</sup>

In August 1978, the investigation of past hazardous waste practices in Erie and Niagara Counties became the mission of the "Interagency Task Force on Hazardous Wastes", which was composed of representatives from the EPA and the New York State Departments of Environmental Conservation and Health. The Interagency Task Force produced a "Draft Report," dated March 1979, which identified 21 hazardous waste disposal sites in the Region, described the activities of 133 waste haulers, and discussed the disposal practices of 90 companies. The Interagency Task Force also surveyed the activities in the Region of the Federal Government's Departments of Energy and Defense. Drawing on the Army's previously prepared "New York Contamination Survey", the FUSRAP studies, and additional responses to questionnaires submitted by each agency to EPA, the Report summarized, in sixteen pages, those Federal Government activities which might have resulted in the production or disposal of hazardous wastes.<sup>16</sup>

While providing a solid foundation for further investigation, the Interagency Task Force Report contained some inherent limitations. The report's discussion of federal sites was necessarily founded, not on independent investigation, but on the responses of the individual federal agencies formerly

utilizing the sites. The exhaustiveness, accuracy and objectivity of the research done by these agencies was an unknown factor. What was required, the Task Force staff agreed, was an independent review of the original records and source materials pertaining to these sites which hopefully existed somewhere within the labyrinthine federal record-keeping system.

a) Initial Document Request to the U.S. Army

The Task Force's first request for Army documentation was greeted coolly. The Army readily agreed to supply the requested supporting documentation to its August 14 Report. However, the three other categories of materials requested, contracts, contamination records and personnel records proved more difficult to obtain. The Task Force was told that contracts were generally destroyed after six years, and thus might not be retrievable.<sup>17</sup> Fortunately, from the Army and other sources, several of the pertinent contracts were ultimately procured. Records relating to the decontamination of surplus Army property in New York were not located or produced by the Army, although some of these Army documents were ultimately retrieved by Task Force investigators from federal archives.<sup>18</sup>

The request by the Task Force for health and personnel records was deemed by the Army to be "impossible" to comply with. The records maintained by the Army, the Task Force was told, were arranged only by name, social security or Army serial number, and not by place of work. Thus, the Army protested, a manual search of over 23,000,000 records would be required to comply with the Task Force's request. Surprisingly however, as the Army's own

documents reflected, Army investigators had apparently succeeded in circumventing this search process. It was reported in the Army's "New York Contamination Survey" that the search of Army historical files had produced a list of Army units in the area and the names and last known addresses of personnel attached to the units. Contacts had been made, it was stated in the report, with "many of the former military personnel who served in the area".<sup>19</sup> Thus, identification of Army personnel by region was apparently not, at least in some instances, the impossible task which the Army had predicted. Subsequently, a list of personnel contacted by the Army was obtained by the Task Force. It proved of little value, since the individuals listed were either not at the address indicated, were not in the Region during the relevant time period, or were already known to the Task Force.

b) Sources Utilized for Research and Record Searches

While federal officials, including the Army, generally cooperated with requests for information and documents from the Task Force, over-reliance on the goodwill and research expertise of the federal agencies involved was clearly undesirable. Thus, whenever practical, Task Force investigators personally reviewed the primary source materials made available. The most significant task was to identify and locate the pertinent material, since federal records had frequently been transferred to storage without having been inventoried or organized in any way. During a four month period, the Task Force staff visited and/or retrieved records or information from the following federal, state and local sources:

- 1) National Archives, Washington, D.C.
  - a. Records of the Reconstruction Finance Corp. ("RFC") and subsidiaries
  - b. Records of the War Assets Administration ("WAA")
  - c. Manhattan Project--Manhattan Engineering District ("MED")
- 2) National Federal Records Center, Suitland, Md.
  - a. Records of the Chemical Warfare Service ("CWS") (review in progress)
  - b. Records of Army Ordnance (review in progress)
- 3) Edgewood Arsenal, Aberdeen, Md.  
(Historical Archives of the Chemical Warfare Service).
- 4) Center for Military History, Washington, D.C.  
(certain CWS and MED materials)
- 5) Army Corps of Engineers (New York Region), Federal Plaza N.Y., N.Y.  
(Audit and Disposal records for surplus Army properties in the Niagara Frontier region)
- 6) General Services Administration ("GSA"), Region 2, Federal Plaza, N.Y., N.Y. (inspection and contamination reports, etc. for federally owned properties which had been declared surplus and made available for public sale)
- 7) City of Niagara Falls
  - a. Files of the Niagara Falls Library
  - b. City of Niagara Falls ("Love Canal File")
  - c. Minutes of the Niagara Falls City Council
8. Niagara County Clerk's Office
9. New York State
  - a. State Archives
  - b. Department of Environmental Conservation
  - c. Department of Health
  - d. Department of Transportation
10. Hooker Chemicals and Plastics Corporation(request pending)

As the preceding summary illustrates, a significant volume of material has already been examined. However, it is likely

that additional sources, which could yield significant data, have yet to be identified. The interim nature of this report is intended to allow for this material, along with other records presently under review, to be incorporated, if deemed necessary, in a subsequent report.

c) Freedom of Information Act Requests

Since a substantial portion of the documents pertinent to the Task Force's inquiry resided not in open archives but in the custody of various federal agencies, requests under the Freedom of Information Act ("FOIA") were filed with twelve federal agencies including the Departments of Energy, Defense, and Interior, and the Environmental Protection Agency.<sup>20</sup> The response of most of these agencies has been laudable, exemplifying compliance with both the letter and the spirit of the FOIA. The Department of Energy, for example, reviewed over 600 boxes of documents, and has produced to date over 12 linear feet of responsive material amounting to 67,588 pages, nearly all of which had to be declassified prior to its release. Significant portions of this Report could not have been completed without these documents.<sup>21</sup>

2. Interviews with Local Residents, Former Army Personnel and Representatives of Private Industry

Documents, however explicit, only tell part of the story. To the extent possible, Task Force investigators attempted to contact and interview the individuals, both in government and in the private sector, who were actually involved with federal projects and facilities in the Niagara-Erie county region.

Frequently, the names of knowledgeable individuals were indicated in the documents being reviewed. A useful starting point was the re-interviewing of many of the individuals contacted by the Army in the course of its 1978 investigation.

Another investigative approach was to identify and interview former and present Love Canal area residents who lived in Niagara Falls during the most active period of government-related activities. Their unique personal recollections were an invaluable and a largely untapped resource.

C. Phase Three -- Private and Public Hearings

1. Appearance by Army Representatives Before the Committee

Pursuant to a formal request by the Assembly Committee on Environmental Conservation, the Task Force's parent body, six military and Army-civilian personnel appeared and testified before the Committee as to their knowledge of and involvement with the Army's 1978 investigation of military dumping at Love Canal.<sup>21</sup> The scope and methodology of the Army investigation and the factual basis for the Army Report's findings and conclusions were thoroughly explored by the Committee, as discussed in greater detail at pp. infra.

2. Public Hearing

On September 8 and 9, 1980, at a public hearing held in Buffalo, N.Y., fourteen witnesses testified under oath before the Committee on Environmental Conservation. The purpose of the hearing was to examine more closely the eyewitness allegations of Army dumping at Love Canal and the nature and extent of military-related chemical production, storage and disposal

activities in the Love Canal region. The Public Hearing produced 522 pages of sworn testimony detailing numerous forms of alleged direct and indirect military involvement in the Love Canal region. This important testimony is explored in subsequent sections herein. The historical context for the events described in that testimony is the subject of the following discussion.

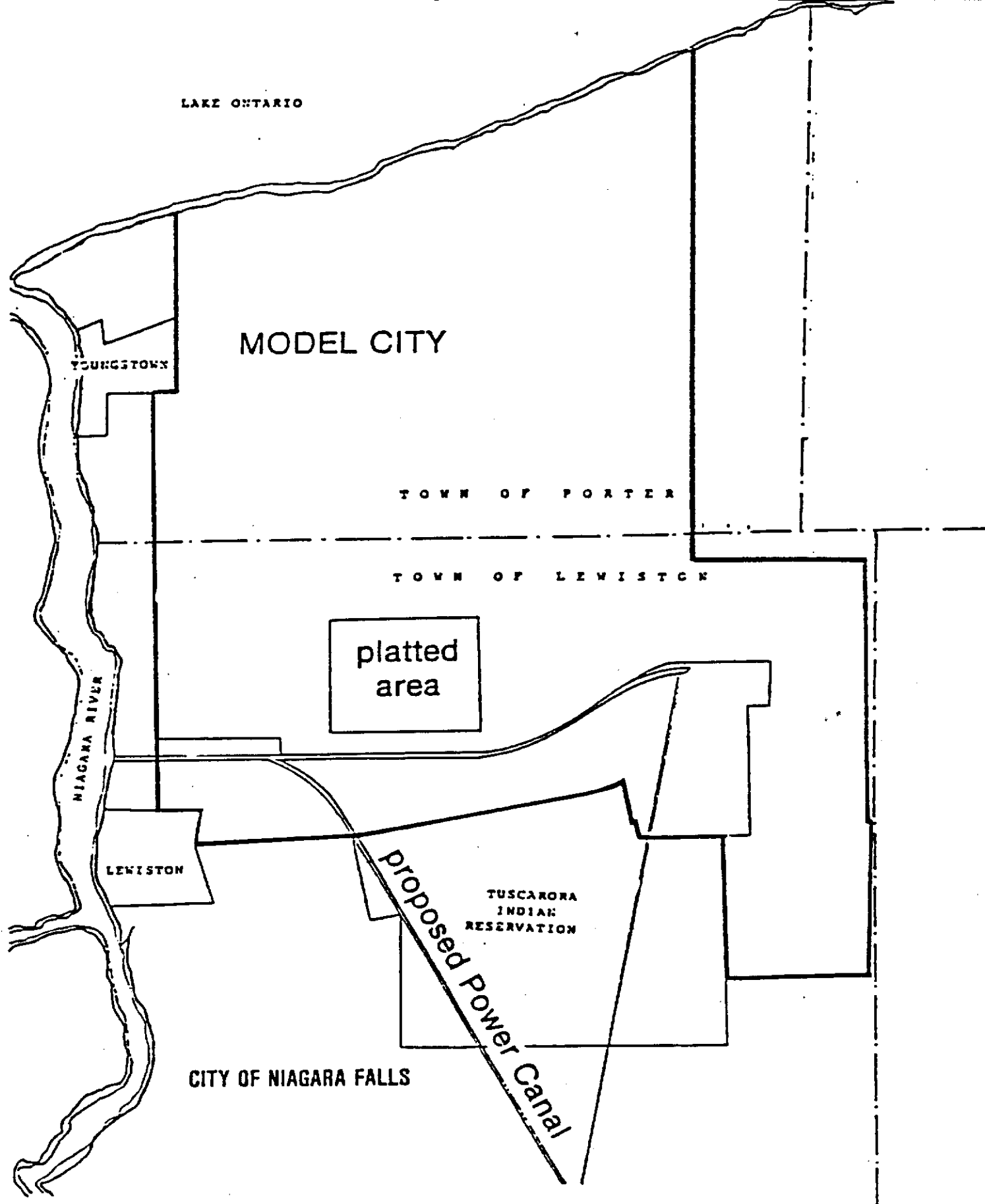
## II. HISTORICAL OVERVIEW OF THE DEVELOPMENT OF LOVE CANAL AND THE FEDERAL PRESENCE IN THE NIAGARA FRONTIER REGION

It is appropriate to begin with a discussion of the origins of Love Canal and the evolution of the Niagara Frontier Region as a major center of the chemical industry and for related federal defense projects.

### A. Love's "Model City" and Power Canal

It is water, and plenty of it, that draws tourists, chemical companies and military projects alike to the Niagara Falls region. The lure of huge quantities of water, over 500,000 tons per minute flowing over the Falls,<sup>23</sup> and the consequent relatively cheap hydroelectric power, was what attracted a savvy entrepreneur, William T. Love, to the region in the early 1890's. Love's ambitious dream was to build a utopian "Model City" on a 20,000 acre site in Niagara County, seven to eight miles northeast of Niagara Falls [See figure 2]. The heart of Love's plan was to construct a six to seven mile power canal, which would connect the upper and lower levels of the Niagara River. The canal would convey water to the brink of the Lewiston escarpment where the 300-foot drop would create a power-generating waterfall. With the attraction of abundant electric power, Love hoped to induce manufacturers to locate at his townsite, forming the industrial nucleus for a great 200,000 inhabitant "manufacturing city" to be quickly established in 10 to 15 years.<sup>24</sup> The fascinating prospectus for "Model City"





**FIGURE 2 - Original Model City Plan**  
(Source: Parry Report 1979)

trumpeted: "Nothing approaching our remarkable plan of town-building in magnitude, perfection or power has ever before been attempted."<sup>25</sup>

Perhaps attesting to his power of persuasion, Love was granted an extremely broad charter by the New York State Legislature in 1893 authorizing the project's development and the right to acquire by condemnation any necessary property.<sup>26</sup> The project proceeded rapidly and favorably. Intricate street plans were laid out and the new city's first factory opened for business in 1893. The development was intensively and enthusiastically marketed<sup>27</sup> and options were soon procured giving Love control of over 20,000 acres at the proposed site. To finance the project, \$5,000,000 in bonds were allegedly sold in Chicago and additional financial backing for the project was allegedly procured.

Construction of the "Model City" began in earnest on May 26, 1894 when, in the "LaSalle" area of Niagara Falls, excavation began on the six to seven mile Power Canal. The proposed Canal was to be 80 feet wide and 30 to 40 feet deep.<sup>28</sup> Unfortunately, only 3,000 feet of the Canal were excavated before Love's visionary project collapsed. The financial depression of 1896, which discouraged the necessary financial backing, was the most significant factor explaining the project's demise.<sup>29</sup> The unattractiveness of the scheme was exacerbated by Louis Tesla's invention of alternating current, which allowed electric power to be transmitted over long distances, thus removing the incentive

of industry to remain close to the power source<sup>30</sup>

The denouement of Love's dream proved painfully slow. Although able to make the first payments on the farms on which he held options, Love's financial support rapidly disappeared. He soon ceded complete control of the project to a New York City syndicate, which kept alive only the plans for the power canal. Even these plans were dashed in 1906 with the enactment of the "Burton Bill" prohibiting further diversions of water from the Niagara River.

Following Love's brief adventure and prior to 1942, the Canal site had faded into quiet oblivion. Only a few houses had been built in the vicinity and most roads were yet unpaved. The Canal gradually filled with water from rainfall. According to some residents, water from an underground spring also filled the canal. Neighborhood children used the area as their playground, sliding and sledding down the banks of earth alongside the Canal, and as a popular fishing and swimming hole.<sup>36</sup>

The first large-scale residential development in the Love Canal area was initiated by the Federal Government in 1940-41, with the construction of the Griffin Manor Housing Project near 96th Street [see figure 4]. This project was used to house defense workers and their families during the war. The Griffin Manor project significantly increased the population density and the level of activity in the area.

The last of the property belonging to Love's former company, the Niagara Power & Development Corp. ("NPD") was reported to have been foreclosed in 1910.<sup>31</sup> However, NPD apparently retained

some interest in the land on which the Canal excavation was begun. Despite its formal dissolution in 1939,<sup>32</sup> NPD's attorneys were still acting on its behalf in 1942, when NPD reportedly entered into a "letter agreement" with Hooker Electrochemical Co. regarding the use of the Canal site. Hooker, for unknown consideration, was permitted, without restriction to dispose of its chemical wastes at the Canal site.<sup>33</sup> Unfortunately, Task Force investigators were unable to ascertain the terms of the so-called letter agreement, to identify the recipients of any resultant payments, or to determine whether any other agreements were entered into with other private or governmental entities.<sup>34</sup> Interestingly, in the same year (1942) that Hooker acquired the right to use Love Canal as a dumping ground, it also received several large, rush, wartime contracts for military-related chemical products.<sup>35</sup>

#### DUMPING AT LOVE CANAL, AND RESIDENT COMPLAINTS BEGIN

Shortly after the Hooker-NPD letter agreement was signed, the use of Love Canal as a chemical waste dump began. The minutes of City Council Meetings as early as 1943 reflect the complaints of local residents<sup>37</sup> concerning the use of Love Canal as a dump. The disposal by Hooker of liquid and solid wastes, both in drums and in bulk, began first in the Canal's northern section.<sup>38</sup> In addition to Hooker's activities, one former Griffin Manor resident interviewed by the Task Force recalled incidents of Army dumping at the Canal as early as 1942 or 1943, also in the Canal's northern end.<sup>39</sup> The dumping of chemicals, both by the Army and private industry, ended Love Canal's use as a swimming and fishing hole.<sup>40</sup>

Finally purchased by Hooker from NPD in 1947, reportedly for \$15,000,<sup>41</sup> the Canal was utilized as a dumpsite at least through April, 1953,<sup>42</sup> when it was conveyed for one dollar to the Board of Education of the City of Niagara Falls. By this time, over 22,000 tons of chemical wastes, by one estimate, had been placed in Love Canal by Hooker.<sup>43</sup>

#### Purported Transference of Liability to School Board

The deed from Hooker to the Board of Education contained a clause which has become the subject of much debate and controversy. Among other things, this clause acknowledged the School Board's awareness that the Love Canal property was filled with "waste products from the manufacturing of chemicals" from Hooker's plant in the City of Niagara Falls. The clause purported to transfer to the Board all liability arising in the future from the presence of these "industrial wastes". It is significant, for purposes of this Report and the pending private litigation, that this clause does not reach those chemical wastes dumped in Love Canal by the military, by other private companies, and even by Hooker, if the wastes originated from plants other than Hooker's plant in the City of Niagara Falls. Even by its own terms, therefore, this tightly-drafted clause may be ineffective in transferring all liability from Hooker to subsequent owners for the chemical wastes from various sources disposed in the Canal during Hooker's period of use and ownership.

The School Board purchased the Love Canal site because it foresaw the impact of the post-war baby boom and correctly

anticipated an increased population in the area.<sup>44</sup> To meet the community's expanding educational needs, the Board commissioned an elementary school to be built on a section of land adjacent to the Love Canal excavation, a section which the Board incorrectly assumed had never been used as a chemical dump.<sup>45</sup> The construction of the "99th Street School" apparently spurred the development of the surrounding area. In 1953 there were 25 homes in the Love Canal area. In less than 10 years, over 150 homes had been built. By 1976, there were over 200 homes in the immediate area. Fortunately, no homes were ever constructed directly over the Love Canal excavation itself.

The post-1953 history of Love Canal is well-documented elsewhere. The controversies surrounding the alleged placement by Hooker of a "clay cap" over the Canal, the alleged subsequent disturbances of the cap by city construction, and the alleged removal of top soil from the Canal by private contractors are all factual issues inappropriate for resolution in this context. The foregoing 1942-1953 history of the Canal's ownership and use is pertinent to this Report to the extent that it coincided with the second great wave of development that was to engulf the Niagara Frontier Region, nearly fifty years after William Love's vision of a Model City -- the arrival and entrenchment of the Federal Government.

## B. Overview of Federal Projects

Ironically, the site chosen for the first major federal project in the Region coincided with the area abandoned by Love in 1896. As one commentator was later to note, "the peaceful life of Model City was broken in the fall of 1942, shortly after the outbreak of war"<sup>46</sup>, when the Federal Government acquired 7,500 acres of land from 149 private land owners for the purpose of constructing a large TNT plant. The site was designated the Lake Ontario Ordnance Works ("LOOW"). The plant, located in the Towns of Porter and Lewiston, approximately eight miles to the north of the City of Niagara Falls [see figure 1] was closed down after only nine hectic months of operation. As discussed at length, infra at 72, part of the site was then used by the Chemical Warfare Service as a storage depot, and by the Manhattan Engineer District for the disposal of radioactive wastes. After the war, 5000 acres of the LOOW site were declared surplus and sold back to private owners. The AEC retained use of part of the site for the storage and disposal of radioactive materials and wastes. DOE continues to store radioactive materials there to this day. In 1954, a large plant for the separation of boron isotopes was constructed. The Army, Navy and Air Force also utilized the site for various projects, as discussed infra at 72-78.

While the huge TNT plant at LOOW was the federal government's most visible presence in the region, in 1942 other equally significant government projects had also quietly begun operation. Although discussed in greater detail infra, a brief

survey of these facilities here will help paint the war years picture.

1. The "Manhattan Project".

In nearby Tonawanda, virtually equidistant between LOOW and the City of Niagara Falls, the Manhattan Engineering District ("MED"), the Army unit supervising the Manhattan Project, had established a sub-office. Its principal function was to supervise the various Manhattan Project facilities whose research and production efforts were contributing to the manufacture of the first atomic bomb. Linde Air Products Co. (now a division of Union Carbide), operated two facilities in Tonawanda, New York for MED, one known as the "Ceramics Plant", [See figure 6] and the other a super-secret research facility known as the Chandler Street Plant.<sup>47</sup> In the City of Niagara Falls, MED paid for the construction of a secret, separately guarded facility known as "P-45", located on the property of Hooker Electrochemical and operated by Hooker and Army personnel. Hooker also operated two other facilities for MED, one for uranium processing and another for the manufacture of a lubricant called "MFL".

Hooker was not the only Niagara Falls company working for MED. The Electrometallurgical Co., now part of the Union Carbide Metals Division, received the uranium tetrafluoride processed by the Linde Ceramics Plant and further processed it to uranium metal. The wastes and sludges from the various MED operations were, as discussed in greater detail infra, stored at two principal locations: at LOOW, and at a site originally



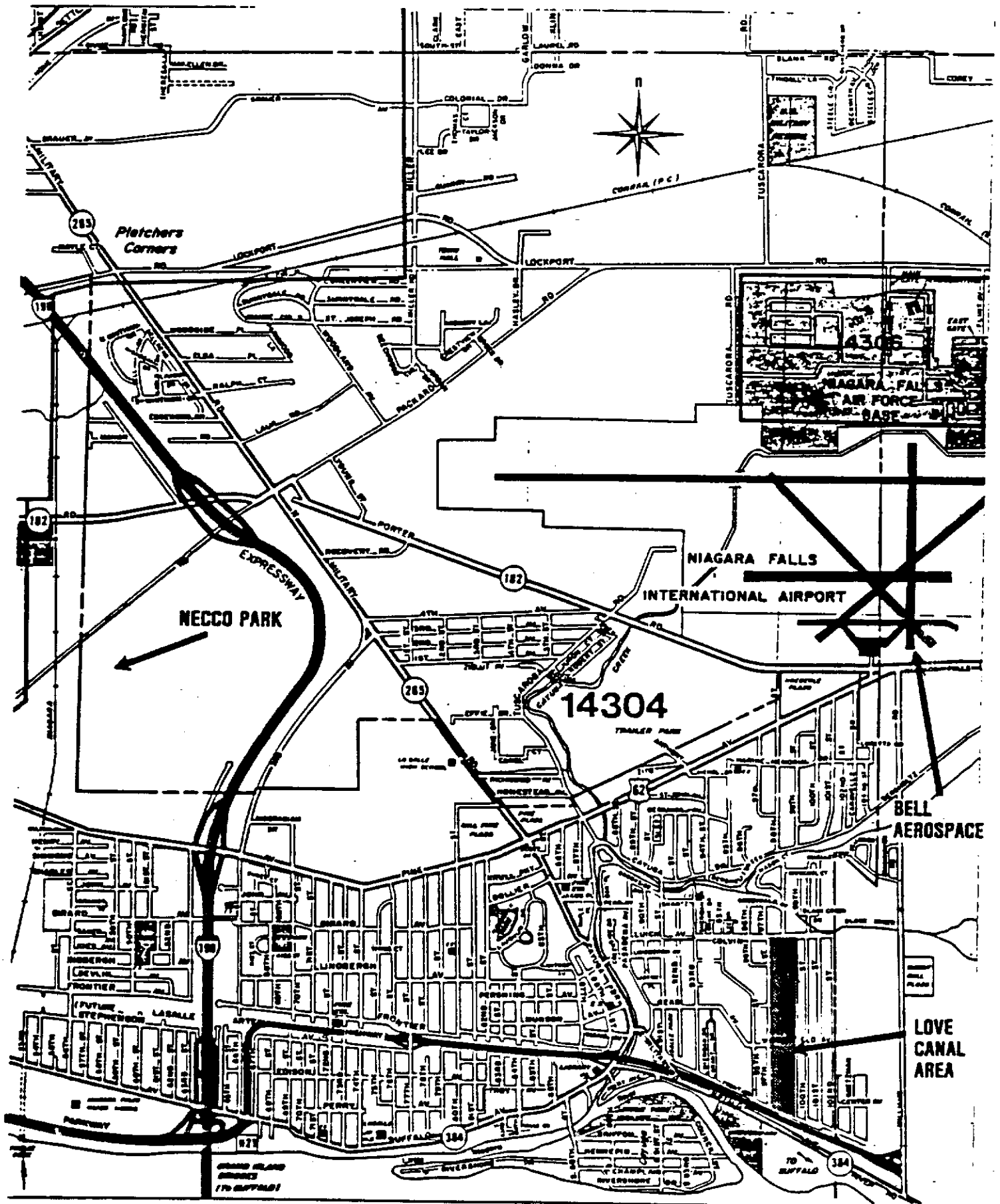
leased, then purchased by MED known as the "Haist Property." [see figure 1]. The Task Force has also learned that radioactive liquid chemical wastes were disposed of in underground wells located near the Linde Ceramics Plant.

## 2. Government-Related Chemical Production

Centralized in a heavily industrial region of Niagara Falls, less than a mile from Love Canal, is an impressive array of some of the chemical industry's leading members, including, among others: duPont, Union Carbide, Hooker, Carborundum, Goodyear Olin and Great Lakes Carbon Co. [see figure 3]. The chemical industry had established itself in the Niagara Falls area as early as 1910, and is today its dominant industry. It is estimated that chemical-related operations now account for more than two-thirds of the area's industrial jobs.<sup>48</sup>

One factor explaining the phenomenal growth of the chemical industry in Niagara Falls and around the country was the pressing demand for chemical products during World War Two and in the defense-oriented period thereafter. It was estimated by a Hooker representative that during World War Two, 60-70% of Hooker's business was "tied up with the war effort."<sup>49</sup> During 1941-45, the dollar value of just the raw chemicals procured by the Army's Chemical Warfare Service ("CWS") amounted to \$421,000,000.<sup>50</sup> The Niagara Falls area was clearly one of the most active industrial centers for chemical production and processing during World War Two, as evidenced by the numerous private companies known to have had government contracts either with CWS, MED, Army Ordnance or the War Production Board:





Carbide & Carbon Co., Carborundum Co., Durez Plastics & Chemicals Co., E.I. duPont, Electromet, Hooker, Innis Speiden, Linde Air Products, Mathieson Alkali Co., Niagara Alkali Co., Niagara Chlorine Co., Oldbury Electrochemical Co., Stauffer Chemical Co., Titanium Co.

duPont's Niagara Falls plant alone had chemical procurement contracts worth nearly \$15,000,000. Hooker's procurement contracts amounted to over \$5,600,000.<sup>51</sup>

In addition to the wartime procurement of raw chemicals from companies located in Niagara Falls, CWS built several new chemical plants, frequently on or close to the property of the private contractor who was assigned to operate the plant. The most significant of these facilities was the Niagara Falls Chemical Warfare Plant ("NFCWP"), located on Buffalo Ave., immediately adjacent to duPonts main plant. [see figure 3]. This CWS plant manufactured "impregnite", a whitish chemical powder used to impregnate clothing to make it impermeable to gas warfare. DuPont operated the plant during World War Two and Hooker operated it in 1951-53 during the Korean War. CWS established two additional new plants in Niagara Falls, both on the property of Hooker itself [see figure 3], one for the production of thionyl chloride, and another to produce hexachloroethane, a compound used to manufacture smoke screen compounds.

As the foregoing summary illustrates, the Niagara Falls region was a busy place during the war years, playing, as it

does today, an important role in our national defense. However Government-inspired industrialization and development, concededly essential and well-intentioned, has taken its toll, as the following discussion makes clear.

## DISCUSSION OF FINDINGS

The findings of fact developed by the Task Force investigation provide the structure for the discussion herein. The order in which these findings are presented roughly tracks the chronology of the investigation -- from its initial focus on the eyewitness reports of Army dumping at Love Canal and the likely origin of such wastes, to a broadened inquiry encompassing the wide range of federal activities which have so significantly affected the environment and the people of the Niagara Frontier region.

### PART ONE -- LOVE CANAL

#### FINDING I

THE DISPOSAL OF TOXIC CHEMICAL WASTES FROM ARMY AND GOVERNMENT-RELATED CHEMICAL PRODUCTION IN THE NIAGARA FALLS REGION CONTRIBUTED SIGNIFICANTLY TO THE TOXIC CONTAMINATION OF LOVE CANAL.

The allegations of Army dumping at Love Canal were, the Army Board of Officers concluded in its report, "not substantiated by available information"<sup>52</sup> A member of that Board was later to concede:

"If we would have found more people who had seen the same account...I think our report would have been entirely different."<sup>53</sup>

In sharp contrast to the Army's investigatory methodology, Task Force investigators actively sought out additional eyewitnesses who could "substantiate" the allegations of Army involvement that first surfaced in 1978. The eyewitness accounts

gathered by the Task Force conclusively establish that Army personnel openly, repeatedly and concertedly disposed of waste materials in Love Canal.

A. EYEWITNESS EVIDENCE OF DIRECT ARMY DUMPING AT LOVE CANAL

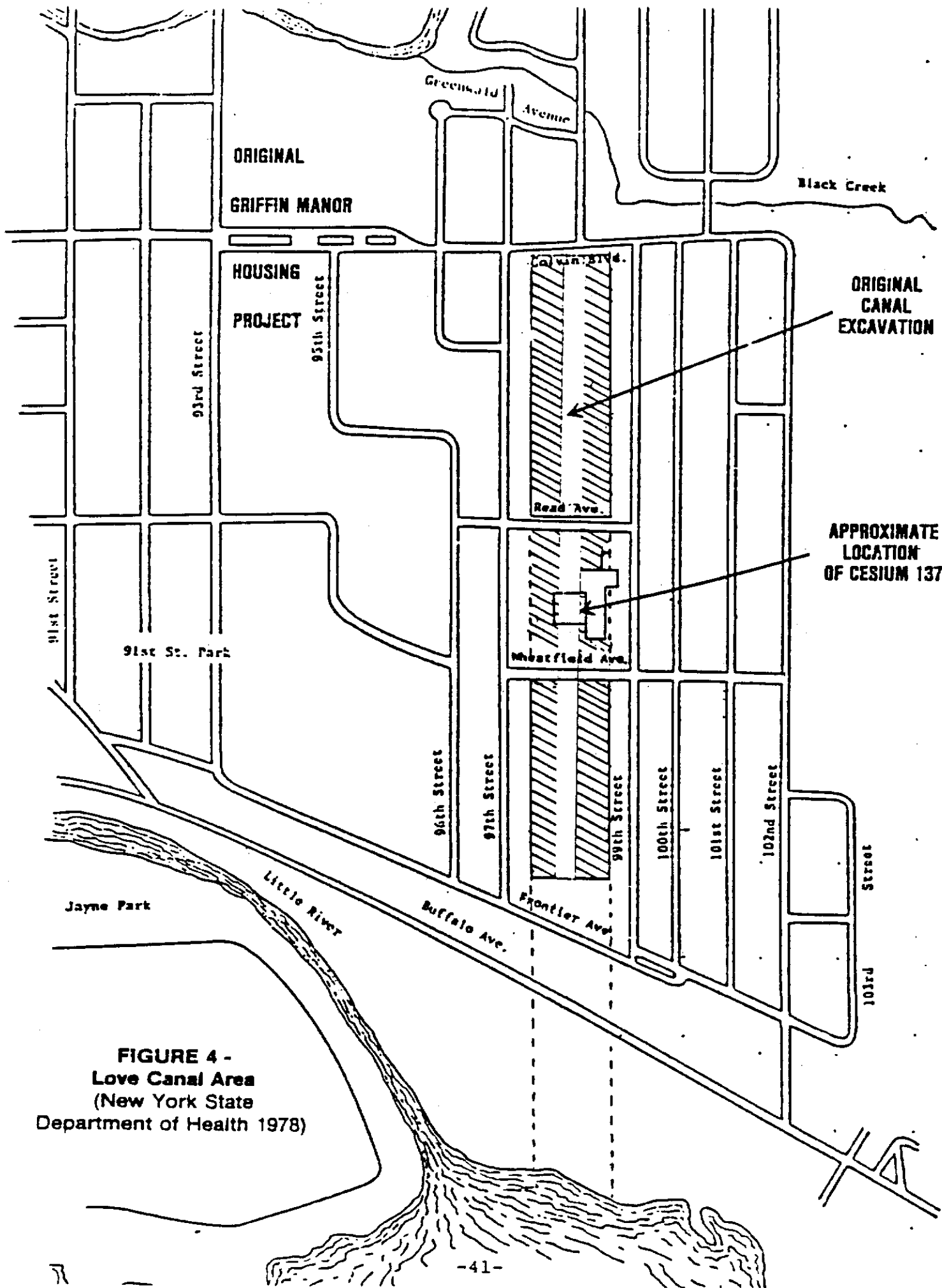
Men with Funny Faces

Olive-drab colored vehicles and Army personnel were implicated in disposal activities at the Love Canal as early as 1942, the year in which several Army chemical facilities commenced operation.<sup>54</sup> Mrs. Lucinda McCombs, a resident of Griffin Manor (a federal housing project adjacent to Love Canal), [See figure 4], recalled that her children, who had been playing on the Love Canal banks, came running home one day to tell her that "funny men" with "faces [that] looked like pigs" were at the Canal.<sup>55</sup> Investigating further, Mrs. McCombs approached the Canal and saw "brownish-green colored trucks" with:

"men on it with the same colored clothes, except that they wore gas masks,<sup>56</sup> and they were dumping containers into the Love Canal."

The men, Mrs. McCombs testified at the Public Hearing, were wearing work overalls, caps, and gloves up to their elbows, and were rolling into the Love Canal "waters" what appeared to be rusty steel drums.<sup>57</sup>

Mrs. McComb's recollections of Army dumping were supported by the Public Hearing testimony of Mr. Alfred Jones.<sup>58</sup> While living at his family's home on nearby 102nd Street, Mr. Jones recalled that he and his companions frequently swam and fished in the "northern" end of Love Canal. When he was 12 years old, in 1942, Jones saw "an Army two and a half ton truck, with three men on a truck, dumping drums".<sup>59</sup> The men wore gree fatigue-type





uniforms, and were dumping what appeared to be metal, 55-gallon containers. Jones recalls only this one incident of Army dumping. He remembered it vividly, however, because when he swam in the Canal after the Army dumped there, his "skin started burning, and whether it was caused by them or not, the chemicals whatever....we had to quit swimming because it burned our skin...."<sup>60</sup>

#### Explosions As Usual at the Canal

Army vehicles, as well as trucks from private companies, were apparently a common sight in the Love Canal neighborhood in the early forties. Mrs. Mary Wahl, who lived on 101st Street near Wheatfield Boulevard from 1939 through 1950, kept a close watch on the trucks which came rumbling down her street. Many were red-colored trucks from Hooker, some were trucks from Mathieson Alkali, and some, perhaps "dozens", Mrs. Wahl noted, were green-colored, open-backed trucks with the words "Army Ordnance" written on the doors.<sup>61</sup> The Army trucks, always carrying at least two armed soldiers, would arrive from the Frontier Avenue end of the Canal. They would typically turn up 101st Street (then unpaved), drive slowly past Mrs. Wahl's home, turn left on Colvin Boulevard (then also unpaved) and cut through a field to dispose of their cargo at the "northern end" of Love Canal.<sup>62</sup> [see figure 4]. Since at this time (approximately 1943-1945) neither 99th or 100th Streets had been cut through, Mrs. Wahl's street, 101st, was the most direct route to the Canal.<sup>63</sup>

While Mrs. Wahl did not go down to the Canal herself to observe the Army's activities, she did recall that when the Army trucks went by her house and turned into the Canal area, they were loaded with drums. The trucks always returned empty.<sup>64</sup> Children playing near the Canal told Mrs. Wahl that the armed soldiers at the Canal had warned them to "stand back" because they "had chemicals here".<sup>65</sup>

It was more for reasons of self-preservation than mere curiosity that Mrs. Wahl kept such close watch on the identity of the trucks in her neighborhood, as she relates:

"I remember seeing the trucks because we always took a close look to see if it was the Titanium because if it was them we had to go in the house and close the windows because there was a fine powder that would come through the air. We had to put a wet cloth on our face because it made us breathe so hard."

(Question: "How often would that happen?")  
"Oh, at least once a week."<sup>66</sup>

The "Titanium", Mrs. Wahl recalled,

"that used to be a factory out at Hyde Park....They were the worst...."<sup>67</sup>

Residents in the Love Canal neighborhood gradually grew numb to what was happening around them. Mrs. Wahl described the scene:

"At night you'd hear these big explosions. We used to say, there goes the Canal again and we would all go back to sleep.....It got so [the firemen] did not even bother."<sup>68</sup>

Not all of the residents were so willing to adapt to Love Canal's new wartime face. Some were angry, and attempted to improve the conditions in their community. The minutes of a May 10, 1943 meeting of the City Council reflect a letter to the Council from a "Mrs. Geschwender" of 865 101st Street "complaining of the

fumes from the Hooker Electrochemical Dump on 99th Street."<sup>69</sup> It is not known whether this first recorded complaint concerning Love Canal was ever acted on or resolved. A petition sent to the Council more than two years later suggests that the nuisance caused by Hooker's dump had not abated. In that petition, 32 residents pleaded for elimination of the "Hooker and Oldbury dumps near 99th Street", alleging that they were "injurious to health and a detriment to property."<sup>70</sup> Few would challenge that assertion today.

#### Armed Guards and Stake Trucks

Despite the complaints, dumping by private industry and Army personnel continued.

Mr. Ruben Licht, an ex-Army staff sergeant and former duPont employee, testified that one afternoon, sometime in 1946 or 1947, his five year old daughter came running back to their home at Griffin Manor and exclaimed "Daddy, an Army truck went up the road, can I go up and see it?"<sup>71</sup> Accompanying his children, Mr. Licht followed the trucks toward the Canal. In his Public Hearing testimony, he described the scene he observed:

"My other little daughter, I carried her, and we got to the end of Colvin Boulevard which was -- ran into a dirt road at the time, a cinder road, and two guys would get off the back of the truck and would not let nobody go up there while they were dumping these drums and two more were on the truck dumping them at the time, about midway up the Canal, towards the north side...."<sup>72</sup>

Licht also testified that, on two or three occasions within a span of several months, he observed flatbed, olive-drab "stake truck-type" vehicles dumping "greenish-looking" drums in the Canal. The truck, so named because of the removable wooden

stakes along its sides, had a white star on the doors, and usually carried four soldiers. Two soldiers guarded the end of the roadway leading to the Canal, while the other two rolled the drums off the truck and pushed them into the Canal.<sup>73</sup> Licht also told Task Force investigators that when he approached the Canal, the guards told him not to advance any further. He recalled being surprised that although it was peacetime, the guards were wearing side-arms.<sup>74</sup>

#### Recollections of The Love Canal Gang

The close of World War Two evidently did not mark the end of the Army's presence in the Love Canal vicinity. Donald Harris, an Army master sergeant and Niagara Falls resident, lived in the Griffin Manor housing project during the late forties and fifties, and recalled that as an eight year old, he frequently swam and played in and near the Canal. He too had a vivid recollection of Army personnel, dressed in work fatigues, dumping drums into his favorite swimming hole:

"There were two occasions that I, in particular, can remember, where military trucks, two different types, on two different occasions, did do dumping.

One was, I guess you would call it, a lift bed dump truck, and the other type was a....what we call a deuce and a half...."

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"[On] the first incident, the dumptruck came in from the bottom portion...what we call the bottom portion of the Canal, from the old....from the area which is now called Frontier Avenue, and...actually drove down into the Canal, at the bottom of it.

Four individuals got out in uniform, one was a supervisor, and the other three actually did the work.

There were approximately six or seven canisters on the back of the truck, they were cardboard type, fibreboard type, with metal rims on them.

These were removed from the truck and put into the bottom of the Canal and very hurriedly covered over with dirt, and just as hurriedly the individuals removed themselves from the area of the Canal."

\*\*\*\*

"It would be the late<sup>75</sup> forties, I would say 1948, 1949. It was in the summer."

Harris was the only witness who had the opportunity to observe the contents of the drums. He testified that:

"...on one occasion, one of the containers, the lid popped off in the operation of removing it from the truck, there was a white powder substance, and when it hit the<sup>76</sup> ground, there was a white cloud that occurred."

The Army trucks, Harris further testified, had a white star on the door,<sup>77</sup> and would arrive in the early morning (8 or 9 a.m.), "do their thing" and then "somebody would eventually plow garbage over them."<sup>78</sup> One of the dumping episodes stood out particularly clearly in his mind, Harris related, because it was on the same day, in a separate incident, that a member of his "gang" was injured.<sup>79</sup> Although Harris could not recall all of his playmates, he remembered that the nickname of one of the boys he played with was "PeeWee". The boy's full name, said Harris, was Fred Downs.<sup>80</sup>

Fred Downs, it may be recalled, was one of the first eyewitnesses to come forward in the spring of 1978 and allege that Army personnel were involved in dumping at Love Canal. Although interviewed during the Army's investigation, Mr. Downs' statements were discounted, because of his age at the time of the incident, and other factors. As one of the Army investigators later told the Task Force, evidence of Army dumping at Love Canal provided by "five-year old children playing in the Love Canal would not impress me, personally, very much."<sup>81</sup>

In retrospect, however, Downs' recollections are fairly impressive. Downs stated that he was between four and seven years old when he witnessed Army dumping at Love Canal, in the late nineteen forties or early nineteen fifties. The written sworn statement which he provided to the Army in 1978 accords quite closely with the recollections of other eyewitnesses. Downs recounted:

"In the early days there were hills on each side of the Canal and a swimming hole in the center. Children from the neighborhood were there most of the time and I remember the older boys swimming and floating on rubber tubes in the pool. Down toward the Niagara River I remember many trucks and other equipment that were dumping barrels, garbage, and other material into the area we called Hooker's Dump. I recall on three occasions the Army dumped drums onto the Hooker area. There were three Army vehicles, a car driven by the Sergeant with an Officer, one truck with Army men in it and one truck with drums. The drums appeared to be larger than the normal 55 gallon and somewhat a different shape. Three or four Army men with heavy white mittens on their hands would push drums off the truck onto the ground. These men also wore a mask over their nose and mouth which they obtained from other workers around the site (Hooker employees). The officer and the sergeant would oversee the operation and I remember the officer had a pouch-type briefcase." <sup>82</sup>

Certain details of Down's statement do not mesh with the accounts of other witnesses to Army activity during this time frame. Donald Harris, for example, did not recall military personnel wearing gas masks or white gloves, or that the drums being dumped were larger than 55-gallon size. However, in some respects, Downs' statement integrated the accounts of other eyewitnesses. In the following section, he recalls the presence of a civilian machine operator who could well have been Frank Ventry and of a boy named "Donny" who might have been Donald Harris:

"After the drums were off the truck, the trucks would pull forward and another man, not an Army person, would push the drums into the hole. The hole was immediately covered with dirt. I did not see any weapons during this operation. This happened two times somewhere in 1949, 1950, 1951 timeframe. However, the third time when the Army people arrived I did not see it because I broke my leg going to the dump, which was the end of summer 1951. Also, the second time that the Army people arrived, I do not remember an Army officer and also do not remember the men wearing gloves or masks. The operation the second time seemed to be more informal. Also the second time there was an argument I remember that there was swearing between the Army guys and a man that was not in the Army who operated the machinery. It appeared that this was not part of the man's job or he was not getting paid for it or something like that. Both times when I observed the Army operations we were standing on a hill some distance from the site. I particularly remember the sergeant the first time because the older boys sent me and another boy (one of the twins, Ronny or Donny, cannot remember the last name) down to see what they were doing, but the officer saw us and instructed the sergeant to chase us away which was promptly accomplished.

The officer wore a jacket which appeared to be brown and the sergeant wore boots, pants, and a top perhaps with a tie. The other Army personnel wore boots, pants, and open shirts. <sup>83</sup>The vehicles were painted a dull brown or gray color.

Donald Harris and Fred Downs were not the only children present in the Canal area on whom these events made such an indelible impression. Corroborating their accounts was the testimony of two brothers, William and Lawrence Jones who, like Harris and Downs, frequently swam and fished at the Canal. William Jones, a lifetime Niagara Falls resident and presently a technical service representative with Great Lakes Carbon Corp., lived on 101st Street close to Colvin Boulevard during the relevant time period. He testified at the Public Hearing that in about 1949 or 1950, when he was 12 or 13, he witnessed several occasions of Army vehicles disposing of drums in the southern end

of Love Canal, near Frontier Avenue. The vehicles used, he recalled, were greenish-colored "stake trucks", with a white star on the door.<sup>84</sup> The trucks would back into the southern portion of the landfill, Jones said, and "get rid of their payloads ... drums of various sizes...55 gallon drums down to twenty gallon drums"<sup>85</sup>. Military personnel would then roll these drums into the Canal. "I can remember three people," Jones testified, "they would all get out of the truck, and we, it was their duty to keep us kids away from there..."<sup>86</sup>

William Jones' younger brother, Lawrence, recalled that his activities at Love Canal were interrupted in the early 1950's by the arrival of olive drab-colored vehicles and uniformed personnel dumping drums in the Canal's southern end:

"We used to have swings, you know, and all that kind of stuff on the trees in there, but every time a vehicle would come to dump, they'd run us off. They'd pull up to you and a couple of guys would stand there."<sup>87</sup>

#### A "Regular Run"

Once the dumping in Love Canal began, said Don Fochee, a Niagara Falls resident, all the fish in the Canal died and it was no longer fit for swimming. Fochee told Task Force investigators that he was 11 or 12 (1952 or 1953) when he first witnessed incidents of Army dumping in the Canal's southern end. The vehicles used were olive-drab colored, two and one-half ton trucks, each with the Army's distinctive white star on the door.<sup>88</sup> Interestingly, Fochee strongly believes that Army personnel were a frequent, almost daily presence at Love Canal. The Army's trip to Love Canal, said Fochee, was part of a "regular run".<sup>89</sup>



Adults as well as children observed Army vehicles at Love Canal, although sometimes from a greater distance. Mrs. Willis Mosher, a Niagara Falls resident, remembered that while she was living in nearby Griffin Manor in the early fifties, she operated a beauty shop in the basement of a house on 98th Street. She recalled that open-backed Army trucks loaded with drums would drive up 98th Street, turn right on Colvin Boulevard and head toward the Canal's northern end. The truck had a driver and two soldiers in back. However, because her view was obstructed, she was not able to observe what the trucks did with the drums once they reached the Canal.<sup>90</sup>

#### Bulldozer Operator At Canal Argues With Army Captain

Frank Ventry's view of Love Canal while he was operating a bulldozer there for the City of Niagara Falls was not obstructed. He testified that in the early fifties he witnessed at least two incidents, close in time, of Army dumping. It will be recalled that Ventry's allegations in 1978 provided the impetus and focus for the Army's investigation. Although Ventry's allegations were never corroborated by Army investigators, neither were they disproven. In light of the close correlation between Ventry's recollections and those of other witnesses, Ventry's testimony takes on added significance.

Ventry recalled one incident in which an Army truck called a "6x6" arrived at the Canal loaded with drums and escorted by a jeep carrying a captain. The captain wore a sidearm and appeared to be supervising the operation. At the time, Ventry was pushing dirt into the Canal on the side opposite the Army truck, near the

Canal's southern end.<sup>91</sup> As a former combat engineer, Ventry had cultivated a "disdain" for Army captains, and "on principle" refused the captain's order to approach. The Canal was wet, and "kind of soupy and I didn't like to walk in it and neither did he", Ventry reminisced.<sup>92</sup> Finally, a staff sergeant relayed the captain's message:

"He wanted me to make a pile of dirt, soft dirt, so he could unload the drums without injuring them and I did that."<sup>93</sup> That is how I remember the Army dumping there.

The soldiers handling the drums were dressed in Army fatigues, with heavy-rubber gloves that went above their elbows. The 15-18 drums, which were shaped like over-sized beer kegs, would, Ventry recalled, be rolled gently off the truck and dropped onto the soft dirt pile he had been asked to form. Instructed by the sergeant to exercise caution and bury the drums in the deepest part of the Canal, Ventry used his bulldozer to carefully push the drums into the Canal at various sections along its length.<sup>94</sup> Significantly, Ventry specifically recalled the sergeant's statement that the Army trucks originated from the Chemical Warfare Plant on Buffalo Avenue.<sup>95</sup>

Love Canal was at that time, Ventry recalled, a well-trafficked site. "Everyone dumped there", he said, "eighty to ninety trucks coming in one day."<sup>96</sup> Ventry also stated that blue-colored Navy vehicles were at the Canal, although in lesser frequency, dumping material that was probably refuse.<sup>97</sup>

#### NFCWP Trucks Seen At Love Canal

Ventry's testimony was the first to link the dumping at Love Canal with the Army's Chemical Warfare Service Plant on Buffalo

Avenue. His recollection has prompted all investigators since to carefully review the waste disposal practices of that facility. Ventry was not the only witness to identify the CWS plant as the likely source of Army dumping. Arthur Tracy, a resident of Niagara Falls since approximately 1945, also testified that the trucks he saw at Love Canal were from "Chemical Warfare on Buffalo Avenue".<sup>98</sup> Tracy, a former pipefitter at Olin Mathieson in Niagara Falls, had lived on 102nd Street, three blocks from Love Canal, for nearly 35 years. He testified that while walking home and while working at a nearby local church, he frequently observed large, green-colored, canvas-topped trucks carrying a driver and two men dressed in green overalls and white gloves, dumping drums into the southern section of Love Canal, in the area from Frontier Avenue to Wheatfield Avenue.<sup>99</sup> Tracy was unable to definitively identify the men as military personnel. However, he was absolutely certain "that these trucks had originated from the "Chemical Warfare parking lot". The Olin facility where he worked was not far from the Chemical Warfare Service plant, and he would pass the Army's plant daily on his way to work. He was adamant that the trucks he saw leaving the CWS plant's driveway, carrying ten to fifteen brown or green drums of 55-gallon size, were the same trucks he saw dumping at Love Canal.<sup>100</sup>

Tracy also testified concerning the unusual procedures employed for dumping the drums. Observing the scene from his close vantage point alongside the Canal, Tracy was puzzled by the truck's work methods. Rather than dumping the load of

green-colored drums in one place, the truck would dump two drums at one spot, then move up the Canal a short distance and dump another one or two drums.<sup>101</sup> As he recalled:

"...I got just as close to that Canal as I could get, because of my curiosity, and I am a taxpayer, [I asked myself] why don't you dump the whole thing into the thing and get me out of here and go about your business, this is what I was thinking, right, and after a while, I got so interested in watching this here thing, that I used to, whenever I was there, and that is the way it happened."<sup>102</sup>

These dumping incidents occurred "lots of times",<sup>103</sup> said Tracy, although he could not pinpoint the years in which they took place, later estimating the likely time period as 1947 or 1948, or 1951-1953, during the CWS plant's second phase of operation.<sup>104</sup> The incidents stood out in his mind with particular clarity, Tracy stated, because several times the drums being dumped in the Canal would open as they hit the water and cause an explosion. He found the scene so fascinating that he actually began to pay special attention to when the Army trucks arrived.<sup>105</sup> As Tracy colorfully recollected, "there was the fish, the water, the fire, it would go thirty feet in the air."<sup>106</sup> He was unaware, he admitted, of the contents of the drums, as he somberly observed:

"I will tell you this, if I knew what I know now what was in those drums, I never would have waited on 102nd Street for anymore babies to be born. I would have gone if I knew what I know now."<sup>107</sup>

## 2. Analysis of Eyewitness Evidence

The statements and testimony of eyewitnesses to Army dumping at Love Canal in the 1940's and early 1950's cannot easily be dismissed. The accounts they provide were for the most part

consistent, credible, and unprompted.<sup>108</sup> While the passage of time has undoubtedly blurred some memories and embellished others, the witnesses were unshakable as to the essential core of the stories they told. For most witnesses, there was some particularly unique or extraordinary aspect of the event which they had seen thirty years ago, or the context in which they had seen it, which made the incident particularly memorable and their recollection believable. In the Task Force's view, the eyewitness evidence establishes conclusively the fact that Army personnel openly, concertedly and repeatedly disposed of drummed materials at Love Canal.

Nevertheless, the eyewitness evidence leaves some important questions unanswered. What was in the drums that were being dumped, and what were the quantities involved? Why was Love Canal used as a disposal site when the Lake Ontario Ordnance Works site was also available? Moreover, the eyewitness testimony was not consistent in every respect: if the Army was present at Love Canal on nearly a daily basis, as one witness recalled, why did some witnesses remember only 1 or 2 incidents and other local residents, none at all?<sup>109</sup> Was it possible that the Army dumping at Love Canal was of such a "de minimus" nature, both from an environmental and legal standpoint, that its actual impact is insignificant, except perhaps as an historical footnote? Assuming that Army personnel were not involved on a regular basis with chemical waste disposal from government plants in the Niagara Falls area how, where, and by whom were those wastes disposed? The Task Force's investigation of these

questions required a comprehensive review of all of the principal military and government facilities in the Niagara Frontier Region that might have utilized Love Canal as a dumping ground for chemical wastes.

B. EXPLORING THE WASTE STREAM: SOURCES OF GOVERNMENT-RELATED CHEMICAL PRODUCTS AND WASTE

1. NIAGARA FALLS CHEMICAL WARFARE PLANT

The most visible military presence in the City of Niagara Falls and the source identified by Messrs. Ventry and Tracy for the Army vehicles sighted at Love Canal was the Niagara Falls Chemical Warfare Plant ("NFCWP"). Located in the highly industrialized section of the City of Niagara Falls, at 3163 Buffalo Avenue, the plant was comprised of several buildings on a 5.2 acres plot. [See figure 3] It was literally adjacent to duPont's Niagara Falls complex and was located on the same "strip" as Hooker, Carborundum and other major chemical companies. While in operation, the plant was served by a direct rail link and was heavily guarded and fenced.

a. Plant History

The NFCWP was built to manufacture a single product, "impregnite", code-named "CC-2", a secret chemical compound developed by CWS scientists at Edgewood Arsenal. CC-2 was used to impregnate clothing to make it impermeable to gas warfare.<sup>110</sup>

The plant at Niagara Falls was one of four CWS facilities specially built for the production of impregnite during the

Second World War.<sup>111</sup> While negotiations between CWS and duPont for the development of a CC-2 process began as early as 1939, the urgency of war accelerated the plans for development. Before the pilot plant that was to be built by duPont even began operation and prior to the process' perfection, CWS contracted with duPont to plan, design, and procure equipment for the four CC-2 plants that were to be constructed nation-wide.<sup>112</sup>

The completion of the Niagara Falls plant was given top priority. The Army moved quickly to acquire the necessary land and to expedite equipment and materials for the plant's construction, pursuant to a cost-plus fixed fee contract.<sup>113</sup> Construction of the plant was completed by February 1942 at a total cost, including the later construction of expanded facilities (doubling the plant's capacity to 1,000 tons per day) of \$4,785,600.<sup>114</sup>

Despite early production difficulties, the plant's operations were in full swing by July 1942. Several Army officers were stationed full-time at the NFCWP to supervise its operations and to expedite the delivery of equipment and raw materials. The plant commanding officer had the rank of major. Because of the experimental nature of the process and the absence of any basis on which to estimate costs, duPont insisted on operating the plant on a cost-plus fixed fee basis.<sup>115</sup> During the plant's 33 months of operation, duPont produced 14,179,074 pounds of impregnite.<sup>116</sup> Interestingly, as early as January 1944, CWS had requested a decreased rate of production since, due to the absence of gas warfare, impregnite stocks had risen to a high

level.<sup>117</sup> Production at the plant ceased entirely when it was placed on "stand-by" in May 1945, and only minimum maintenance work was performed at the plant in the 1946-1951 period.<sup>118</sup>

Inadequate maintenance at the plant during these years, combined with the plant's steadily deteriorating condition due to corrosion, took its toll. In February 1951, as the Korean Conflict flared, the Army again believed it needed impregnite and Hooker was awarded a contract for the rehabilitation of the NFCWP and the manufacture of 2 million pounds of impregnite.<sup>119</sup> Due to the plant's poor condition, substantial construction and rehabilitation was required.<sup>120</sup> Full-scale production commenced in early 1952. Operations at the plant were terminated in May 1953, by which time a total of 3,200,000 pounds of impregnite had been produced.<sup>121</sup>

Following the Korean Conflict, and Hooker's subsequent brief use of the plant's laboratory in connection with the AEC-Hooker Boron-10 project at LOOW, the Niagara Falls plant was again mothballed. Stand-by maintenance contracts were awarded first to Olin Mathieson and then in 1961 to Machelor Maintenance and Supply Corp.<sup>122</sup> The plant was finally declared excess in 1963 and transferred to the General Services Administration ("GSA") subject to National Security Clause restrictions, which meant that it had to be kept available for government re-utilization. Unable to dispose of the plant, GSA returned it to the Army in 1965.<sup>123</sup>

The intensification of the Vietnam War led to the initiation of discussions between the Army and Hooker concerning the



reactivation of the plant, either with Hooker as operating contractor or as owner. These discussions continued unsuccessfully through 1968. The decision was finally made not to reactivate the plant at all<sup>124</sup> and it was sold to the City of Niagara Falls in 1972 for \$149,500.<sup>125</sup> In 1974, the plant was apparently leased to or purchased by the Solvent Chemical Co.; their operations at the plant ceased in September 1978. The Frontenac Corp. reportedly purchased the plant in 1980.

b. Production Difficulties

From its inception, duPont encountered an array of production difficulties at the NFCWP. The haste with which full-scale operation had begun, even prior to perfection of the process, led to various bottlenecks and technical crises.<sup>126</sup> The 3-step process (known as the trichloroaniline-urea process) for producing impregnite was a relatively straight-forward one,<sup>127</sup> requiring raw materials such as acetic acid, aniline, chlorine, sodium carbonate, urea, sulfuric acid and zinc oxide.<sup>128</sup> The principal problem duPont encountered was that its finished product contained an insoluble residue that could not be removed in the final stage. Thus, batch after batch failed to meet Army specification<sup>129</sup> and had to be reworked. The Task Force found no evidence to suggest that this off-specification material was ever disposed of.<sup>130</sup> By January 1943, after intensive research, duPont had sufficiently improved the quality of its product so that 80% of it met specifications.

Another factor seriously affecting production was the "extremely severe" corrosion conditions at the plant, arising

from the highly reactive nature of the materials used. A process development engineer with duPont recalled that his responsibility was to design new equipment to limit the effect of the corrosive materials used in the process.<sup>131</sup>

#### Acid Fume Emissions

Understandably, the same materials which were corrosive inside the plant were equally corrosive when released outside the plant. The "new arrival" on Buffalo Avenue soon caused considerable problems for its neighbors. As early as May 1942, 34 residents from the residential area surrounding the NFCWP petitioned the City Council for an investigation into the release of "acid fumes" from the plant.<sup>132</sup> Shortly thereafter, it was reported that a Council investigation was underway and that the installation of a "gas eliminating machine" was expected to solve the problem.<sup>133</sup> A final report on the matter from the City's Health Officer was submitted to the City Council on July 1, 1942, in which it was noted that "many of the trees near the NFCWP are now putting out new leaves which would be an indication that the nuisance has been abated so far as is possible."<sup>134</sup>

The nuisance apparently did not abate, as reflected by an August 1943 petition to the City Council from 68 residents complaining of "unbearable gas condition" in the area surrounding the Army plant and requesting "that something be done to relieve the terrible condition under which they have been living."<sup>135</sup> Two weeks later, on August 30, 1943, the City Manager, in a letter to the Council, responded to the petition by stating that the matter had been under investigation for over a year, with

strenuous efforts having been made to eliminate the cause of the complaint. In addition, he reported that, "gas washing apparatus" had been installed in one of the plants emitting noxious fumes, which it was believed would improve the situation. The City Manager stated further that he hoped to determine whether harmful gases came from "any other source than the one most apparent," to identify the character of the gases in the atmosphere, and to determine if they would imperil health or destroy vegetation. The City Manager concluded:

"The complete removal of all odors from this area which is surrounded by war industries may not be possible but it is to be reasonably expected that at least gases proven to be harmful can be either eliminated from the atmosphere entirely or so diluted as not to endanger public health. My study of this whole matter will not be discontinued until substantial improvement is secured."<sup>136</sup>

Air pollution from the Niagara Falls plant and other government-related chemical manufacturing plants persisted throughout the war. The minutes from a City Council meeting in September 1944 stand as stark testimony to wartime conditions in Niagara Falls and the inability or unwillingness of local government to alter these conditions:

"Councilman Keller stated that he had received numerous complaints about gas escaping from sewers, especially in the neighborhood of 24th Street and that many people had been made ill by it and that in several instances people found it necessary to remove small children from the neighborhood..."

"...he thought it was time the industries did something about correcting this situation; he stated that he believed the industries could curtail the discharge of gases and that they could neutralize all of the gases before discharging them. He further stated that he realized these industries were engaged in war work; but that they should still take into consideration the welfare of our citizens and that they

could greatly improve the condition without in any way affecting their production."

"Councilman Keller moved that the City Manager take up this matter with the heads of all the industries with the aim of putting a stop to this condition."

"Councilman Maloney stated that the fumes from the Chemical Warfare plant has killed the trees in the Echota section and asked that all the plants be included in the request."

"The Mayor said that he did not think the City Manager could stop them..."

"....He knew of one instance where the head of an industry told the City that they were neutralizing all the sewage and that on the same day they had dumped fifteen tons of chlorine directly into the City sewers."<sup>137</sup>

The message was clear. There was apparently little that could be done to prevent the death of trees close to the Chemical Warfare Plant or the escape of gases from the City sewers. The residents would simply have to adjust to being continually sickened by emissions and to the evacuation of their small children from the area.<sup>138</sup>

In some sense, emissions from the NFCWP reflected the fact that in the 1940's, air pollution control was in its nascent stage and the technology was relatively primitive. The pollution from the NFCWP, plant documents indicate, was apparently due to uncontrolled releases of chlorine and acetic acid into the atmosphere. It was the latter which served as an effective defoliant, destroying the vegetation surrounding the plant. The plant's operating manual recounted "local air pollution complaints" arising from the chlorine releases<sup>139</sup> which ultimately caused a change in operating procedures at the plant and the installation of more effective air pollution control

equipment.<sup>140</sup> It is ironic however that the new smokestack "scrubber", designed to cut down on acid fume emissions at the plant, was apparently not ordered until after the plant had completed operations in 1953.<sup>141</sup>

The inadequacy of the plant's air pollution equipment was confirmed when, in 1971, in contemplation of the plant's sale to private owners, the federal General Services Administration conducted an appraisal of the plant. Not surprisingly, in large part because of the extensive and costly equipment changes that would be required to meet current pollution control standards, an engineering consultant recommended that the plant be scrapped.<sup>142</sup>

c. Nature and Quantity of Waste Products Generated

In addition to impregnite and air pollution, the NFCWP generated significant quantities of solid and liquid wastes, in the form of both sewered and drummed residues. The quantities produced and the ultimate disposition of these wastes were of obvious significance to the Task Force's inquiry.

Liquid Wastes Sewered

It was estimated that at step 1 of the process alone, 48 pounds of liquid wastes were sewered for every 100 pounds of impregnite produced.<sup>143</sup> The pH (acid-alkaline) level of these sewered wastes was adjusted by the addition of lime prior to discharge, but left untreated in the effluent were highly toxic "red oils" containing o-chloraniline, p-chloroaniline, 2-4 dichloroaniline, tetrachloroquinone and various phenolics.<sup>144</sup> Both the drummed and sewered wastes contained these "red oils," as well as other by-products from the first stage of the process.

Warnings regarding the toxicity of these compounds, in the workplace at least, were repeatedly made. The production manual cautioned that aniline was "highly toxic"<sup>145</sup> and that contact with the skin or inhalation of the vapors of the chemicals or the by-products handled "must be avoided".<sup>146</sup> The area surrounding the "P-1 recovery still", which produced most of the red-oil laced solid residues was, the Manual cautioned, "among the most dangerous and toxic in the plant." It should be well-ventilated, operators were advised, and workers in the area watched carefully for "signs of toxic poisoning."<sup>147</sup>

#### The Problem with Red Oils

The warnings concerning the toxicity and potential hazards from "red oil" residues hardly understated the danger. Another major consideration in the 1968 decision not to reactivate the NFCWP was the fact that the toxic red oils present in the plant's sewered and drummed wastes grossly violated then-current pollution standards.<sup>148</sup> While incineration of the "red oil" residues was finally proposed by Hooker as an alternative means of disposal,<sup>149</sup> this method was not pursued since a new process for manufacturing impregnite, in which "red oils" were not even formed, had been developed by Upjohn Co.<sup>150</sup> In light of Upjohn's new process, the NFCWP was deemed obsolete and was therefore recommended for disposal.<sup>151</sup>

#### Disposal of Solid Wastes

In addition to a substantial amount of liquid effluent, the NFCWP produced sizable amounts of solid and semi-solid wastes. Because of their high levels of toxicity, these residues could

not be sewered and had to be landfilled. Undetermined (but probably small) quantities of semi-solid residues containing "red oils" were produced in the first stage of the process (P-1),<sup>152</sup> but substantially larger quantities were produced in the process' second stage. This waste included a sludge, known as "P-1 still residue," which resulted from a distillation and filtration step. This sludge reportedly contained unreacted P-1, trichlororaceteanelide, quinones and phenols.<sup>153</sup> The drummed wastes also included spent filter cakes, filter cloths, and floor sweepings.<sup>154</sup> P-1 still residues accounted for a significant portion of the drummed residues from the NFCWP. According to Hooker's technical supervisor at the NFCWP, Fred Olotka, the manufacture of 100 pounds of impregnite generated 12 pounds of P-1 still residue.<sup>155</sup>

#### Quantity of Solid Residue Generated

Assuming the accuracy of this estimate,<sup>156</sup> the total quantity of drummed P-1 still residue from the plant can be readily approximated from the production figures. During the duPont period of operation in World War II, when over 14 million pounds of impregnite were produced, drummed residues would have amounted to 1,700,480 pounds. Assuming that 55-gallon drums were used, and that each drum weighed approximately 500 pounds,<sup>157</sup> duPont would have disposed of approximately 3,400 drums from the plant during its period of operation (not including an undetermined number of drums filled with filter clothes, etc). Using the same formula, Hooker, who produced 3,200,000 pounds of impregnite at the NFCWP during 1951-1953, would have generated

384,000 pounds of drummed P-1 recovery still waste, amounting to roughly 770 drums.<sup>158</sup> How and where these wastes were disposed of is explored in the following section.

d. Burial Grounds for NFCWP Toxic Wastes

The NFCWP operating manual [See Appendix] directed that the sludge from the P-1 still be drawn off into drums, then "carried to a dump and discarded."<sup>159</sup> It was "good practice to bury this material", advised the manual, because

"it might contain appreciable amounts of P-1 which has the same toxic properties as aniline. Otherwise, children playing around the dump might be affected."<sup>160</sup>

(i) Disposal during Plant Operation by duPont

Although the duPont employees interviewed by the Army investigators in 1978 gave somewhat inconsistent accounts as to the existence and quantity of solid waste from the plant,<sup>161</sup> the Army investigation concluded that any waste generated at the NFCWP during duPont's period of operation would have been disposed of by duPont employees at "Necco Park",<sup>162</sup> a landfill owned and operated by duPont. According to some employees, this was the standard practice at the time.<sup>163</sup> No evidence of military transportation and disposal of waste was uncovered by Army investigators, who found that the disposal of waste products from the plant was duPont's responsibility and would have been performed by duPont employees. The Army Board of Officers Report stated:

"personnel familiar with the plant and its operation were unanimous in stating that there were no uniformed personnel and no military trucks ever used to dispose of wastes from this plant, and in fact, such personnel and vehicles were never observed within the plant property."<sup>164</sup> (emphasis supplied)



## Army Trucks at NFCWP

Although Task Force investigators did not uncover conclusive evidence as to Army dumping of NFCWP wastes during the duPont years, it is worth noting that the personnel interviewed by the Army were in fact something less than "unanimous" concerning the question of whether Army trucks were present at the plant. Joseph L. Finster, a lieutenant and later captain (assistant property officer) at the plant during the 1943-1945 period recalled (in an interview with Army investigators) the presence of a large 1½ to 2½ ton olive-drab dump truck at the NFCWP during this period.<sup>165</sup> This truck, Finster later told the Task Force, was open in the back, had metal sides, and white identification markings on the hood.<sup>166</sup> It was used for miscellaneous tasks, he remembered, such as picking up supplies and equipment at the railroad station. It could have been used for waste disposal, Finster said, although he did not specifically recall this use, and believed that waste disposal was principally duPont's responsibility.<sup>167</sup> A duPont employee similarly informed the Task Force that the Chemical Warfare Service stationed two small (1/2 ton) olive-drab trucks, without insignias, at the plant site.<sup>168</sup> A Niagara Falls contractor also recalled that had rented to the Army for use at the NFCWP two 1 1/2 ton Ford dump trucks, with steel bodies and 18 to 24 inch sides. They were returned in such poor condition, the contractor remembered bitterly, that he considered suing the Army for the damage.<sup>169</sup>

The presence of these trucks, particularly Army trucks, is significant. Not only does it directly contradict one of the

Army's key findings, but it also supports the testimony of various eyewitnesses who believed that the trucks they saw at Love Canal were from the NFCWP and were used to dispose of chemical wastes from the plant. Why the Army needed trucks at the plant at all is somewhat puzzling. Clearly they were not required to transport the finished product from the plant, since impregnite was shipped out to depots around the country entirely by rail.<sup>170</sup> According to one former duPont employee, the Army trucks at NFCWP were in fact utilized for waste disposal. William O'Connor, a duPont accountant who worked at the NFCWP during World War II, testified at the Public Hearing that, on at least one occasion, he observed an olive-drab Army truck leaving the NFCWP, loaded with what appeared to be waste drums and bulk material.<sup>171</sup> Surprisingly, although O'Connor's name was known to Army investigators, he was never interviewed by them.

O'Connor further testified that, at the time of this incident, an officer at the plant, former Captain Joseph Finster, informed him that the trucks were headed for the Lake Ontario Ordnance Works site.<sup>172</sup> When queried, Finster did not recall this conversation with O'Connor. Finster had however previously suggested to Army investigators that wastes from the plant might possibly have been sent both to duPont-owned sites or to the LOOW site, where the Northeast Chemical Warfare Depot was located.<sup>173</sup> The evidence supplied by Messrs. O'Connor and Finster establishes that, contrary to the findings of Army investigators, Army trucks similar to those seen at Love Canal were in fact stationed at the NFCWP during World War Two.

### Disposal During Plant Operations by Hooker

Wastes from the World War II operation of the plant, the Army concluded, were probably disposed of by duPont at Necco Park and not Love Canal. In contrast, the Army found that during Hooker's operation of the plant in 1951-1953, when Love Canal was a primary Hooker disposal site, it was probable that Love Canal was used as a disposal site for NFCWP wastes. In this regard, the Army Board of Officers Report stated: "It is probable that most if not all of the solid and liquid chemical wastes" generated by Hooker in the 1947-1953 period "ended up in the Love Canal site, or in a waste disposal area within the Hooker chemical complex."<sup>174</sup> The question of who actually dumped NFCWP wastes into the Canal is more troublesome. Army investigators found no evidence to substantiate the eyewitnesses' allegations that Army personnel were involved in dumping at Love Canal.

The Task Force investigation, although it definitively establishes the Army's presence at Love Canal, does not resolve the question of where those Army personnel originated. Most puzzling is the fact that none of the Army or civilian personnel interviewed could recall Army vehicles or soldiers being used to haul and dispose of wastes from the NFCWP during Hooker's period of operation.<sup>175</sup> Even more surprising was the fact that no one could remember precisely how those wastes left the plant. A Hooker "yard gang" employee (later foreman) who had been involved in all aspects of Hooker's disposal operations at its various sites during this period stated that he did not pick up any drums from

the NFCWP and did not know who did.<sup>176</sup> Carl "Bud" Wagner, the owner of an independent trucking company which was frequently employed by Hooker for work of various types at Love Canal, testified at the Public Hearing that he and his employees never picked up drummed residues from the NFCWP or hauled such wastes to Love Canal and that he never saw Army personnel engaged in such activity.<sup>177</sup>

#### Linkage Between NFCWP Waste and Chemicals in Love Canal

A separate line of inquiry explored by Army investigators was the comparison of the wastes produced at the NFCWP with the chemical compounds identified in Love Canal and the surrounding area in tests performed by the New York State Health Department and others.<sup>178</sup> Two common substances used in the impregnite process, amino acid and butyl acetate, were identified at the Canal, but no compounds "unique" to the NFCWP process, the Army Report stated, had been discovered in any chemical analyses which had been performed.

Surprisingly, the Army report failed to mention the tentative identification in the Canal area of chlorinated aniline compounds which were produced in the first stage of the impregnite process. The Task Force's interest in the presence of this particular compound was aroused by a statement made by Arnold Arch, the NFCWP's former commanding officer, in his 1978 interview with the Army. Commenting on the Army's list of chemical substances found in the Canal, Arch stated:

"I find it rather curious that Aniline does not appear on the list of chemicals identified as chemicals detected at the Love Canal Site. If the Army had used Love Canal as a dumpsite for waste from our process at

the US Army Chemical Warfare Plant, the presence of aniline used in the production of CC2 would be a dead give-away."<sup>179</sup>

Inexplicably, the Army had reviewed but apparently ignored evidence concerning the presence of aniline-type compounds in the Canal area. An EPA report (appended to the Army's Board of Officers Report) had in fact tentatively identified the presence of chlorinated anilines, such as di- and trichloroaniline, in the basement of a home adjacent to the Canal.<sup>180</sup>

Chloroanilines, while not an "Army-unique" compound, were integrally related to the manufacture of impregnite.<sup>181</sup> The highly toxic "red oils" contained in the waste from the first and second stages of the impregnite process were, it should be recalled, composed of o-chloroaniline, p-chloroaniline, and 2-4 dichloroaniline.<sup>182</sup> Moreover, the presence of chloroanilines in the Canal was deemed significant by observers other than Col. Arch. In fact, the Interagency Task Force's conclusion, that wastes from the NFCWP were likely to have been disposed of in Love Canal was based on Hooker's admission that amongst the waste types it disposed of in the Canal were chlorinated anilines.<sup>183</sup>

Although the Army investigators claimed to have reviewed the EPA studies appended to their Report, the tentative finding made by one of those studies indicating the presence in the Canal area of chlorinated aniline was not discussed or pursued. One of the Army investigators later stated to the Task Force, "....I don't remember chloroaniline being found at the time we did the study."<sup>184</sup>

(e) Summary of NFCWP Evidence

At least three important facts have been established. First, a total of at least 4,170 drums of highly toxic chemical residues were generated at the NFCWP during the 1942-45 and 1951-1953 periods. Second, Love Canal was used as a chemical waste disposal site from 1942 until 1953 and was probably used by Hooker for the disposal of NFCWP wastes. Third, chemical compounds resembling the waste produced at the NFCWP have been tentatively identified in the Love Canal area and are of the waste type Hooker has admitted dumping in the Canal.

The identity of the person(s) hauling the NFCWP chemical waste remains to be established. During duPont's period of operation, it is probable that a significant portion of the NFCWP waste was disposed of, possibly by duPont employees, at a duPont-owned site, Necco Park. However, duPont was not the only entity with waste-disposal capability. Contrary to the Army's findings, Army trucks and personnel were present at the NFCWP during duPont's period of operation. In fact, one former duPont employee recalled an incident involving Army trucks leaving the plant loaded with drums. In addition, a long-time resident in the Love Canal area swore that the green-colored trucks he saw at Love Canal were the same trucks he had observed in the parking lot of the NFCWP.

During Hooker's operation of the plant in 1951-1953, Love Canal was one of the principal disposal sites then in use by Hooker. It is logical that NFCWP wastes were disposed of in Love Canal by Hooker civilian personnel during this period. Moreover,

according to one eyewitness, the Army personnel seen dumping at Love Canal identified themselves as having originated from the NFCWP. It is likely, therefore, regardless of whether it was the Army, Hooker, or an independent who did the actual hauling and dumping, that a significant portion of NFCWP's waste ended up in Love Canal.

One fact is clearly established--military personnel were observed in the Canal area on multiple occasions. The possibility that Army and government-related facilities in the Niagara Falls region other than the NFCWP could also have used Love Canal as a disposal site is explored in the succeeding section.

## 2. THE NORTHEAST CHEMICAL WARFARE DEPOT

Since several witnesses had testified that Army vehicles and personnel were active in the Love Canal region throughout the 1942-1953 period,<sup>185</sup> the Task Force attempted to identify all of the potential military sources for such sightings. An Army facility at which there were both Army vehicles and enlisted men<sup>186</sup> was the Northeast Chemical Warfare Depot ("Depot"), which formally began operation on June 23, 1944. The 1,100 acre Depot was located on the site of the 7,500 acre Lake Ontario Ordnance Works [see figure 5], where the TNT plant had recently been deactivated after just nine months of operation. The Depot met the Chemical Warfare Service's need for a regional storage place for incendiary bombs, high explosives, and other items. The LOOW site was ideal because 1) there were 58 pre-existing "igloo"

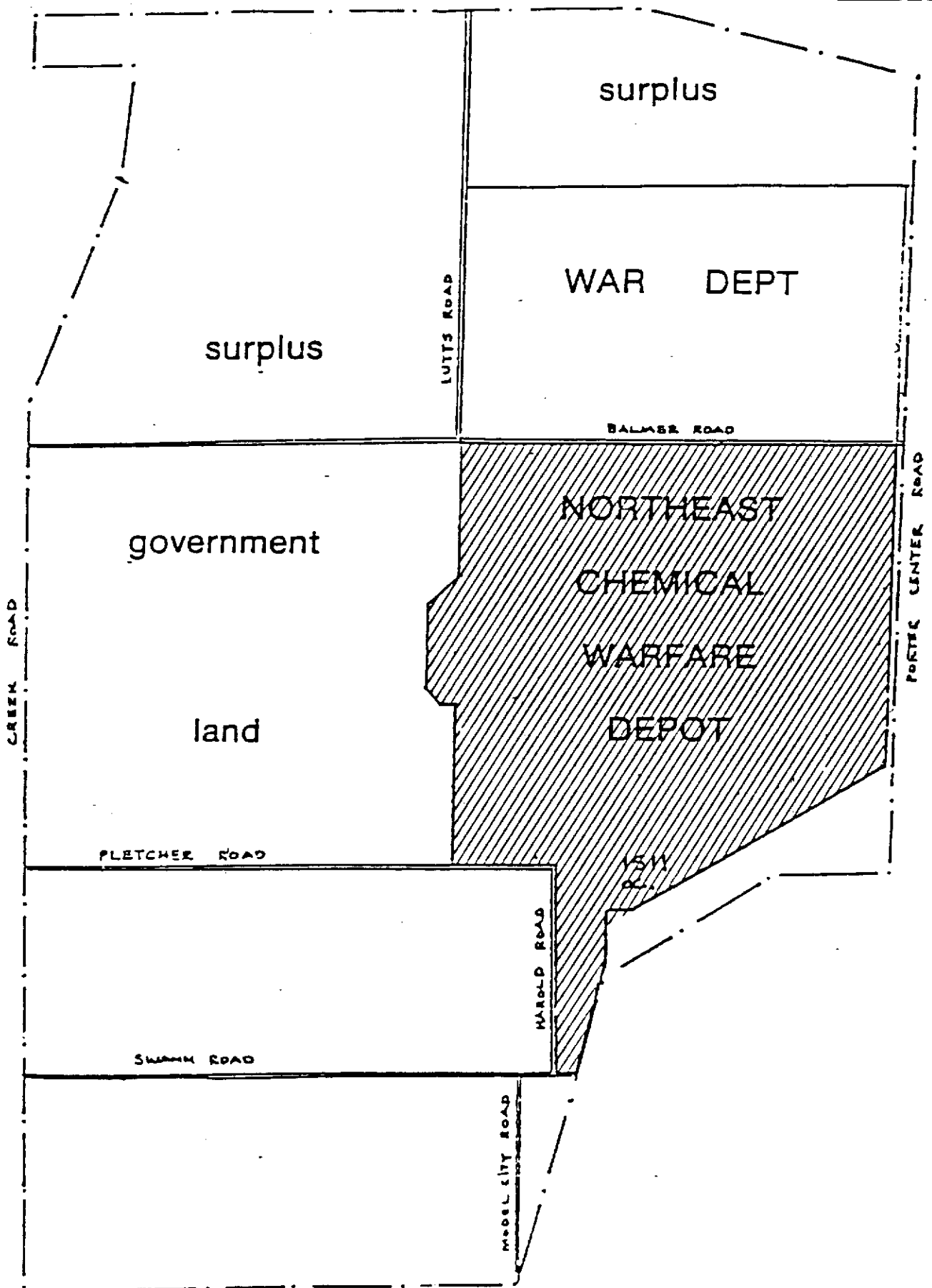


FIGURE 5 - Northeast Chemical Warfare Depot, 1944  
(Source: Parry Report 1979)



buildings (previously used for the stockpiling TNT munitions) which could be used for storage without additional construction; 2) it was close to the points of production and shipment and; 3) it had been built with excellent rail facilities.<sup>187</sup>

The Depot's major problem was that it was located in a region which, due to heavy wartime industrial activity, was plagued by a severe civilian labor shortage. Staffing the Depot temporarily were two military units, the 190th Chemical Depot Co., and the 71st Smoke Generator Chemical Co. These units were assigned to the Depot only for brief periods. After their withdrawal, a contingent of fifty enlisted men who had returned from overseas was sent to the Depot. Due to their inferior performance they were soon withdrawn.<sup>188</sup> Desperate for manpower, the Depot scoured the civilian labor market and even competed for the services of the German prisoners-of-war who were situated at nearby Fort Niagara. The prisoners, however, could only work at the Depot on rainy days, since in good weather they were assigned to fruit-picking in the surrounding orchards.<sup>189</sup>

Since many of its activities required transportation, the Depot had a fairly large motor pool. An August 1945 inventory showed 28 vehicles at the site, including a 2 1/2 ton dump truck, a 3 1/2 ton truck, several light trucks, and two passenger sedans.<sup>190</sup>

#### Post-War Storage of Impregnite at the Depot

In addition to the stockpiling of munitions, the Depot was used for the storage of impregnite produced at the Niagara Falls Chemical Warfare Plant.<sup>191</sup> Army investigators were unaware

of this use.<sup>192</sup> While the quantities stored at the Depot are not known, it is noteworthy that during the Depot's period of operation, substantial quantities of impregnite were produced at the NFCWP. In 1944 and the first five months of 1945, 4,069,246 pounds and 1,753,886 pounds, respectively, were manufactured at the NFCWP. Most of the finished product was probably shipped out directly by rail, but significant quantities<sup>193</sup> were apparently also stored at the Depot, at least for an undetermined period of time.<sup>194</sup>

#### Unaccounted Disposal of Surplus Impregnite

The provocative question -- what was done with surplus impregnite after the war's end -- was raised, but never pursued by Army investigators. Since there had been no significant chemical warfare, impregnite stocks were high and there was probably a fair amount of the material which had not been impregnated into clothing.<sup>195</sup> The ultimate disposition of this surplus material was not determined by Army investigators. In an early report, summarizing the document review they performed, it was noted:

"at the end of the war, probably thousands of pounds of impregnite were left and what was done with it, there is no record. No record of dumping large amounts of drums anywhere."<sup>196</sup>

To obtain more information, the investigators recommended that the records of the Corps of Engineers Surplus Property Section or the Salvation and Redistribution branch be searched. It was hoped that this would yield an explanation as to "what actually happened to all the leftover impregnite".<sup>197</sup> This question was never answered or investigated by the Army in the course of its inquiry.<sup>198</sup>

Resolving the question might explain some of the events described by eyewitnesses. Donald Harris, it will be recalled, testified that he had seen Army personnel dumping cardboard or fibreboard-type drums into the Canal. When one of the drums broke while being dumped, he said, whitish powder spilled out.<sup>199</sup> It should be noted that impregnite as a finished product was packed exclusively in drums of the type Harris described and is a whitish, powdery substance.

Another clue as to what might have been done with the materials stored at the Northeast Chemical Warfare Depot after the war is provided by a September 1945 memorandum regarding "post-war storage" issued by the Chief of the Chemical Warfare Service to depot commanders throughout the country. Once "war reserve and peacetime requirements had been established", it was advised, all "excess material" would be disposed of directly from the individual installation, to avoid duplicate handling and transportation".<sup>200</sup> In late September, the commander of the Northeast Chemical Warfare Depot, Major Homer Deschanes, apparently requested clarification or expressed uncertainty as to the CWS' policy concerning post-war storage. The answer he received reflected the tempo of the hectic demobilization period:

"We intend to move the stock from your depot as soon as practicable, but the exact date must depend on the ability of other depots to handle. It has been necessary to ship returns from overseas to Northeast because of the overall situation in regard to transportation, space, labor, etc. We are making strenuous efforts to resist personnel reductions at your depot at this time, but when activities decline there will be some decreases in personnel allotments."<sup>201</sup>

## Army Manual Recommends Disposal of Surplus Impregnite

Although the Task Force found no direct evidence that the impregnite produced at the NFCWP and stored at the Northeast Chemical Warfare Depot was disposed of in the region at the war's end, such practices would have been consistent with the Army's disposal policies at the time. A 1948 Chemical Corps (successor to the CWS) manual entitled "Disposition of Chemical Corps Items"<sup>202</sup> [See Appendix] instructs that impregnite was to be considered surplus, that it was commercially unsaleable and could be safely disposed of locally by burial, by burning<sup>203</sup> or by being spread on the ground surface.<sup>204</sup> A directive accompanying the Manual advised commanders of the then-remaining Depots (Northeast was deactivated by this time) that they should forthwith dispose of all "obsolete and unauthorized items", including munitions and toxic chemical agents.<sup>205</sup>

The 1948 Manual recommended that impregnite be demilitarized<sup>206</sup> (i.e. disposed of) because of its status as a "classified" material.<sup>207</sup> Similarly marked for "demilitarization" were inherently hazardous items such as bombs, shells, and toxic agents and items (or their containers) which had deteriorated or become unserviceable to the extent of creating a hazard.<sup>208</sup>

There were three principal methods for demilitarizing impregnite outlined by the Disposal Manual,<sup>209</sup> all of which provide a glimpse of the Chemical Corps' state of mind with regard to disposal and the prevailing state of the art:

"a) One method of disposal is to scatter the material on the surface of ground which will not be used for agricultural purposes. Scattering should be done on a rainy day, to prevent the powder blowing away. The action of a few rains will effectively remove the impregnite.

b) Disposal by burial is feasible for these items. The pit should be deep enough so that the top layer of material is not less than 3 feet below the surface of the ground. The disposal site must be selected at a location which takes sources of drinking water supply and drainage systems into consideration. The post engineer should be consulted in locating the site and details of the method to be employed. During approximately 6 months, normal rains in most localities will suffice to remove the impregnite.

c) Small quantities of the impregnites may be disposed of by burning on the surface of the ground, using wood as the combustible material. When over 200 pounds are involved, the pit burning method (see page 9) is preferable. Since chlorine is released when these impregnites are burned, the operation should be conducted on a day favorable for rapid disposal of the gas. A safety zone 300 yards downwind and 200 yards wide is adequate."210

Even in 1948, it is questional whether these primitive practices reflected the "state of the art" and current knowledge. Testifying at the Public Hearing, an engineer from the NFCWP who was familiar with the chemical nature of impregnite and its potential toxicity read the above excerpt from the Manual and observed:

"I am shocked by this...in no way could I condone doing what they want to do with this material..."211

#### Post-War Disposal Difficulties and Disasters

The disposal of impregnite by scattering it on the ground or by burning it in pits is perhaps less "shocking" when these practices are viewed in their historical context. Moreover, it is likely that the policies and practices described in the 1948 Disposal Manual were similar to, or represented improvements upon the disposal methods utilized immediately following the war, when

the Northeast Chemical Warfare Depot was still in operation and when CWS depots and facilities throughout the country were reportedly "bulging" with surplus items.<sup>212</sup> Some insight into the events witnessed at Love Canal can perhaps be gained from a brief review of the problems confronting the military with regard to the storage and disposal of toxic materials and the decontamination of former military facilities that after the war were returned to civilian use.

Contributing to the post-war storage and disposal problem were thousands of tons of toxic agents--a material described as toxic "goop", and certain raw chemicals such as arsenic trichloride and ammonium chloride which had been produced in huge quantities for use by the CWS and later found to be commercially unsaleable.<sup>213</sup> Interestingly, arsenic trichloride, a chemical used in the manufacture of the toxic gas lewisite, had been produced in large quantities for CWS by Hooker at its Niagara Falls plant.<sup>214</sup> The fate of any surplus arsenic trichloride from the Hooker plant is not known.

The root of the Chemical Warfare Service's problem, observed its former chief chemical officer, Major General Alden Wait, was the War Department's inability or disinclination to allocate sufficient funds for the storage of toxic agents or for their proper disposal. The CWS, he once stated "couldn't afford to keep [toxic gases, such as mustard and lewisite] or dispose of it".<sup>215</sup> As with the disposal of radioactive wastes,<sup>216</sup> it apparently became the practice to dump unwanted poisonous gases into the ocean. Shortly after the war, 33 leaking German mustard

gas bombs were dumped into the Gulf of Mexico, 60 miles off the Alabama coast. A fish kill off the coast of Florida was, although without definite proof, attributed to this dumping activity.<sup>217</sup>

The War Department apparently also lacked sufficient funds to fully decontaminate the many sites it had utilized during the war, many of which were used for the storage of toxic materials or which contained hidden hazardous materials buried beneath the surface. Documents retrieved by the Task Force from federal archives reflect the policy disputes raging amongst the various agencies in Washington as to the entity ultimately responsible for decontamination of surplus property, the degree of decontamination required and the warnings and disclaimers required to be given to private individuals purchasing "formerly contaminated" property and equipment. Much apprehension was expressed by various agencies as to whether the Government, despite its disclaimers, might remain perpetually liable for injuries resulting from the use of still hazardous land and equipment.<sup>218</sup> Other conflicting government policies placed less emphasis on caution. High protection and maintenance costs and a post-war "seller's market" for used industrial equipment were some of the economic factors inducing prompt disposition of surplus government property.<sup>219</sup> Ultimately, the fear of liability and the occurrence of several unfortunate accidents resulting from insufficiently decontaminated property restrained to some extent the WAA's disposition program.

Accidents Resulting from Insufficient Army Decontamination  
of Equipment and Real Estate

One of those accidents occurred in 1946, when two workers were killed by an explosion while welding on a piece of pipe salvaged from a government war plant. The pipe was allegedly contaminated by explosives.<sup>220</sup> Following this accident, commanding officers of military chemical and explosive plants were directed to withhold shipments to WAA of "formerly contaminated" equipment pending a review of decontamination procedures. WAA was advised to discontinue sales of such equipment until further inspection was made.<sup>221</sup>

The decontamination of real property formerly utilized by the military proved equally troublesome. In June 1948, three men on a fishing trip were seriously burned when the truck in which they were riding hit and exploded what was believed to be mustard gas shells originating from Camp Sibert, an Army installation in Gadsen, Alabama. The accident occurred on a tract of land adjacent to Camp Siebert which had recently been sold without restriction to a private owner. The plot adjacent to the site of the accident was part of an "impact area" used by Camp Sibert and had been sold with the restriction that the land be used for grazing purposes only, thus evidencing the Government's suspicion that unexploded munitions might lay beneath the surface rendering the land unfit for agriculture. However, the Army was apparently unaware that the adjacent land was also contaminated.<sup>222</sup> Ironically, only several months prior to the accident, parts of



Camp Sibert itself had in the interests of public safety been withdrawn from the WAA's inventory of surplus government land. It had been determined that due to "toxic gas contamination", the site could not be used for any purpose, and would "remain dangerous for years to come."<sup>223</sup>

The accident near Camp Sibert illustrated the tragic consequences arising from the insufficient decontamination of surplus property sold to private owners and the hazards created by the Army's ignorance of the extent of the residual contamination remaining on or near former Army sites. The potential for injury arising from post-World War II Army activities and practices is no less real today.

#### Court Holds Government Liable For Negligent Decontamination

In 1964, two persons were severely injured and two were killed when a 37 millimeter warhead exploded after it had been retrieved on the grounds of a Texas ranch, once part of a World War II Army artillery range. In a subsequent lawsuit charging the Federal Government with negligence, a Texas federal court held the Government liable for the deaths and injuries incurred, citing the Army's failure to adequately police and decontaminate the ranch land prior to its return to private ownership and the Army's failure to post adequate notice warning the public of the dangers from unexploded projectiles remaining on the land.

The court's findings with regard to Army decontamination methods at its former site, as set out in a reported decision, Hernandez v. United States, 313 F.Supp. 349 (N.D. Texas 1969), are significant. For several years following World War II, the court noted, the Army had publicized the hazards from unexploded

shells still remaining on the former artillery range site through the news media and personal contact with local ranchers. Ranchers were urged to contact an Army demolition team for removal or explosion of these shells. The court noted that the intensity of Army efforts to warn residents of the possible presence of unexploded shells and the dangers of handling them "faded" within three years following return of the land to its civilian owners. Warning signs that had once surrounded the former artillery range site were allowed to deteriorate so that only one was left standing at the time of the accident, fifteen miles from the area where the shell was found.

The Court also found that the Army's inspection and decontamination efforts at the former artillery range were wholly inadequate. Unsurprisingly, the German prisoners of war who were used to "police" the area by walking around it did not perform satisfactorily. Moreover, the Army's visual inspection of the land could not uncover the many projectiles which were buried or obscured by brush. The Army did not use metal detector devices at the site despite their availability. The court also found that Army officials were aware that unexploded shells had been left in the artillery range area and that their decontamination program was inadequate. For this reason, they recommended that the land be used only for grazing, not for farming. The latter activity, it was apparently feared, might unearth buried shells.

Importantly, the court in Hernandez explicitly rejected the Government's contention that federal liability for the former artillery range site terminated in 1946, when it returned the

premises to its owner. Negligence on the part of the Government or any wrongdoer was not to be excused, the court stated, simply because the negligent act was committed on land that had since been conveyed. Thus, the Hernandez holding implies that the Government is in essence perpetually liable for injuries resultant from its negligent failure to inspect and decontaminate formerly utilized sites and to post adequate warnings or otherwise deter public access onto contaminated lands. The legal impact of this decision should be carefully considered in the context of the examples of residual contamination at former Army sites located in the Niagara Frontier Region, discussed infra.

#### Buried Phosgene Gas Cylinders At LOOW

In December 1970, an AEC radiological team surveying the Lake Ontario Ordnance Works site for radiation hazards unexpectedly encountered a sign at the site warning "Danger, Phosgene Gas Stored Here." Although the press was actively covering the radiological survey then being conducted, AEC officials apparently did not, at least at the time, make the phosgene discovery publicly known. Rather, the AEC quietly called in Army Chemical Warfare experts from Edgewood Arsenal to assess the situation.<sup>224</sup> One of those experts later appeared as an Army representative testifying before the Assembly Committee on Environmental Conservation. He stated that phosgene gas cylinders were in fact determined to have been buried at the LOOW site, as indicated by the warning sign, but that when discovered the cylinders were empty and posed no hazard.<sup>225</sup> What was less clear was why the deadly gas cylinders had been buried in the ground in the first place and why the Army's disposal records did

not clearly map the location of the burial ground so that future users of the site would be aware of its location.

3. OTHER ARMY AND GOVERNMENT-OWNED OR EQUIPPED PLANTS AND FACILITIES IN THE NIAGARA FALLS REGION

The urgent wartime demand for raw chemicals and chemical products spurred the construction of several new or expanded chemical plants in the Niagara Frontier Region. Typically, the Government would either pay the entire cost of construction of these facilities, pay for their equipment, or agree in advance to purchase the products they manufactured. Responsibility for the disposal of chemical waste from these facilities was generally ceded to the operating contractor. Significant quantities of these wastes were, at best as can be determined, disposed of in Love Canal as well as in other disposal sites in the Region.

a. Thionyl Chloride Plant

Along with the Niagara Falls Chemical Warfare Plant, one of the Region's most significant Chemical Warfare Service facilities and one of the largest waste producers, was a plant equipped by CWS, at a cost of \$199,000, to produce thionyl chloride<sup>226</sup> for CWS' exclusive use. The facility was located on the grounds of Hooker's main plant in Niagara Falls in a building owned by Hooker for which no rental was charged to the CWS.<sup>227</sup> The plant incorporated a new Hooker process which was subsequently employed at two CWS plants located in other parts of the country. Because of early wartime demand, Hooker also converted one of its own plants to produce thionyl chloride. When requirements for this product were cut back in late 1943, the Army ordered Hooker to

shut down the CWS plant, which was accomplished by November 30, 1943. By this time, the two plants had produced a total of 3,909,320 pounds of thionyl chloride.<sup>228</sup>

The production of thionyl chloride resulted in substantial amounts of drummed waste. Hooker representatives estimated that the thionyl chloride process was the "greatest contributor to Hooker waste [during the war] possibly as much as 40".<sup>229</sup> Moreover, wastes generated from thionyl chloride production were quite hazardous. Because of their explosiveness, the drums containing thionyl chloride residues had to be handled with special care.<sup>230</sup> These wastes were also highly toxic, consisting of toluene solvent contaminated with thionyl chloride residues and other solid materials.<sup>231</sup>

The likely disposal site for these wastes, Army investigators determined in 1978, was the landfill located in the southern portion of Hooker's main plant, and "other landfill sites" used by Hooker in the late 1940's and 1950's.<sup>232</sup> Love Canal was, of course, one of Hooker's principal disposal sites during this time period. Because the individuals involved are now deceased, it shall probably never be known whether it was merely a coincidence that Hooker's use of Love Canal as a chemical dump began in 1942, the same year that the thionyl chloride plant began operation. It is not an unlikely hypothesis that the initiation of the heavy waste-producing thionyl chloride process encouraged Hooker to acquire Love Canal.

One thing is clear: substantial amounts of thionyl chloride waste were generated by Hooker and disposed of in the Niagara

Falls area. In response to a questionnaire from the Interagency Task Force, Hooker confirmed that 500 tons of thionyl chloride waste were dumped at Love Canal during 1942 through 1952.<sup>233</sup> Interestingly, New York State Department of Health tests reveal the presence of toluene, which was one of the residues from the thionyl chloride process, in the Love Canal area.<sup>234</sup> In addition, 4,200 tons of thionyl chloride wastes were reportedly disposed of at Hooker's "S", "N", and 102nd Street landfills.<sup>235</sup>

b. Dodecyl Mercaptan Plant

One of the most impressive achievements of American industry during the Second World War was the crash program to produce synthetic rubber. Not surprisingly, Hooker played an important role in achieving this goal. At its main plant in Niagara Falls, it operated a facility producing dodecyl mercaptan ("DDM"), a component chemical used as a "modifier" in the synthetic rubber process.<sup>236</sup> In 1943, over one million pounds of DDM were produced by Hooker for a wartime government corporation, the Rubber Reserve Company, a subsidiary of the Reconstruction Finance Corporation ("RFC").<sup>237</sup> During 1944, in response to greatly increased demand, Hooker's plant capacity was increased 325% and annual production was increased to 3,804,000 pounds.<sup>238</sup>

A significant amount of drummed waste was generated by Hooker's DDM operation. The Army's 1978 investigation did not explore this question, presumably because the Rubber Reserve Company was not an Army operation. It was, however, a government-sponsored corporation, a fact which becomes particularly significant in assessing the DDM plant's

contribution to Love Canal contamination. Hooker has estimated that, between 1942 and 1952, it disposed of 2,400 tons of DDM wastes into Love Canal.<sup>239</sup> Undoubtedly, a significant portion of these wastes were produced during the wartime synthetic rubber program. It has not been determined whether Rubber Reserve Company officials were aware of how and where wastes from the DDM process were being disposed.

c. Hexachloroethane Plant

Hexachloroethane, a principal ingredient in the manufacture of smoke screen material, was produced by Hooker at a CWS-equipped plant located at Hooker's main facility. According to Hooker personnel, although Hooker produced over 3,600 tons a year of hexachloroethane, no significant amount of wastes resulted.<sup>240</sup>

d. Arsenic Trichloride Plant

Simply to meet wartime demand by the CWS, Hooker was required to expand the 100-ton capacity of its arsenic trichloride plant by 3500%. Arsenic trichloride was used to produce lewisite, a war gas. Waste from the arsenic trichloride production process, Hooker representatives told Army investigators, would primarily have been neutralized and discharged to the sewers. Other residues might have been landfilled on the Hooker site or at other landfills in use at the time.<sup>241</sup>

e. Hooker and the Manhattan Project

Among the facilities supervised by the Tonawanda Area Office of the Manhattan Engineering District ("MED"), the Army unit

responsible for the Manhattan Project, were three plants in Niagara Falls operated by Hooker Electrochemical. Hooker's chemical expertise was highly valued and quickly exploited by MED during the initial, hurried phases of research and development of the atomic bomb.

#### "P-45" Plant

In 1943, at a cost of \$7,613,740, MED constructed a new facility code-named "P-45". The plant was situated on a five acre plot within the main Hooker compound in Niagara Falls. P-45 was fenced off from the main plant and was closely guarded by non-Hooker personnel. A security clearance was required for entrance.<sup>242</sup>

The plant was designed to produce a liquid substance called hexafluoroxylene, which was then shipped in tank car quantities to Oak Ridge for use in the gaseous diffusion process.<sup>243</sup> Although originally designed to produce 40,000 pounds of hexafluoroxylene per month, a larger plant had to be constructed when product requirements were tripled.<sup>244</sup> As of July 1944, the plant had produced 1,214,137 pounds of the material, and had a contract to produce 405,363 pounds more.<sup>245</sup> Hooker operated the P-45 plant for MED (in its own words) "acting as an agent for the U.S. Army".<sup>246</sup> Interestingly, two Hooker employees who had enlisted in the regular Army were transferred back to Niagara Falls and assigned to work at the P-45 facility, presumably at Army pay.<sup>247</sup>

It is believed that production of hexafluoroxylene resulted in both drummed residues<sup>248</sup> and liquid wastes which were



neutralized and sewer<sup>249</sup>. The drummed waste from the various distillation steps in the process<sup>250</sup> was believed to consist of a semi-viscous chlorinated xylene which was not water-soluble.<sup>251</sup> The MED documents reviewed to date do not indicate where these drummed wastes would have been disposed of, although the Hooker representatives interviewed by the Army suggested that, due to the highly-classified nature of the process, it was unlikely that they would have been disposed of "in the Hooker area".<sup>252</sup> The P-45 plant was sold to Hooker in 1948, apparently for \$171,000.<sup>253</sup>

#### Processing of Uranium Slag

The production of hexafluoroxylene (P-45) resulted in large quantities of waste hydrochloric acid. Utilizing this waste, MED constructed an additional building, on Hooker property, to receive uranium bearing slag by rail from Linde Air Products.<sup>254</sup> The slag was coated with a whitish oxide which would be removed in a bath of hydrochloric acid.<sup>255</sup> The slag was then shipped back to Linde. This operation continued from 1943 through 1945.

The waste liquid from this refining processing was reportedly discharged to the sewers.<sup>256</sup> Although these effluents might have contained radioactive particles, albeit in small quantities, they were not monitored for radioactivity, either by Hooker or MED.<sup>257</sup> According to Fred Olotka, a Hooker employee who was familiar with the P-45 operation, the lack of monitoring was consistent with MED's failure to inform Hooker personnel that the material being processed was uranium. In this regard, Olotka testified that:

"in those days, we had no idea whether this material was radioactive. We did not know it was uranium... it had to be after the war effort had ended and they indicated to us what the materials were that we have handled, and where they went."

"....you could not worry about an item that was not present to worry about, despite the fact that it may have been radioactive."<sup>258</sup>

The failure to supply important technical information to private contractors involved in secret operations with MED and other government agencies was, in Mr. Olotka's opinion, not an uncommon phenomenon. "During World War Two and the Manhattan Project", he observed, "nobody knew what anybody was doing, and that is a fact."<sup>259</sup>

#### "MFL" Production

In one of the P-45 buildings, Hooker produced small quantities of polymeric trifluorochloroethylene, also called Miller's Fluorolubricant ("MFL"), a lubricant which was produced for MED's Oak Ridge operations. The MFL process produced no waste products requiring disposition, according to the Hooker representatives interviewed by the Army.<sup>260</sup>

#### f. Other Manhattan Project and Early AEC Operations In the Niagara Frontier Region

##### Electromettallurgical Co. (Union Carbide Metals Division)

In the period 1943-1953, uranium tetrafluoride from the Linde Air Products plant in Tonawanda was shipped to the Electromet facility in Niagara Falls [see figure 3] where it was processed and converted to uranium metal.<sup>261</sup> This government-constructed plant was sold to Electromet and eventually demolished in 1957.<sup>262</sup> According to a former MED

official, the liquid waste from the process, which was probably slightly contaminated by uranium, was sewer<sup>263</sup>ed.

#### Linde Air Products

Linde Air Products operated two separate facilities for MED in Tonawanda, N.Y., one a five-building complex known as the "Ceramics Plant"<sup>264</sup> and another called the "Chandler Street Plant."<sup>265</sup> The Ceramics Plant, under contract with MED in 1942-1948<sup>266</sup> processed uranium ore to uranium oxide, and uranium oxide to uranium tetrafluoride.<sup>267</sup> The five Ceramics Plant buildings were sold to Linde when its contract with MED expired.<sup>268</sup> The Chandler Street Plant, whose secret operations remain classified to this day, was involved in the production of "barrier materials" for the K-25 plant in Oak Ridge, Tenn.

#### Uranium Rolling (Simonds Steel, Bethlehem Steel)

Between 1948 and 1956, Simonds Steel rolled and forged between 12,500-17,500 tons of uranium and 15-20 tons of thorium at its Lockport plant, pursuant to contracts with the Atomic Energy Commission. Bethlehem Steel's Lackawanna plant also received a part-time AEC contract for the rolling of uranium billets in 1949-1951.<sup>269</sup> Worker exposure to excessive levels of radiation at these plants is presently being investigated by a local United Steelworkers union.

#### 4. ARMY CHEMICAL PROCUREMENT FROM PRIVATE COMPANIES IN NIAGARA FALLS

During the war, Chemical Warfare Service and Army Ordnance procured massive quantities of raw chemicals from private companies for use in various government projects. Since in most instances, the private companies involved already had the

capacity to produce the needed material, no new government plant construction or equipment was required. DuPont's plants across the country provided an important industrial resource. Its Niagara Falls plant alone had 45 war supply contracts amounting to \$14,886,000, and accounted for the production of various chemical compounds, including tetrachlorethylene, perchlorethylene, trichlorethylene, sodium cyanide, as well as impregnite.<sup>270</sup> Between 1941 and 1947, the Army procured by contract from Hooker's Niagara Falls plant various chemical compounds, including chlorinated benzenes, tetra- and hexachlorobenzene, chloronapthalene and carbonyl chloride (phosgene).<sup>271</sup> Hooker's representatives reported that there were no significant residues from these manufacturing processes.<sup>272</sup>

#### 5. LOVE CANAL, LAKE ONTARIO ORDNANCE WORKS AND THE CESIUM MYSTERY

In August, 1978, persistent reports by area residents of Army dumping at Love Canal prompted New York State Health Department officials to conduct a radiological survey<sup>273</sup> of the Canal area.<sup>274</sup> Their mission was not to determine the origin of any radioactive contamination that was found but, if such contamination was present, to determine whether it posed an immediate health hazard to the workers who would be performing remedial action at the site. That work would undoubtedly include soil excavation and the potential exposure of contaminated material.<sup>275</sup>

## Inexplicable Presence of Cesium

Radiologists from the Health Department first conducted a "walk-around" beta-gamma survey of the entire length of the Canal and then, to allow more detailed analysis, collected soil samples at areas which showed elevated levels of radioactivity.<sup>276</sup> The results of these radiological surveys disclosed low-level radioactive contamination throughout the site, contamination which was deemed not to pose a radiological hazard at ground surface.<sup>277</sup> The presence of low-level radioactive contamination in the Canal was not surprising. Slightly radioactive phosphorus slag waste was produced in great quantities in the region, and might have been dumped in the Canal along with chemical wastes.

However, not all of the survey's findings could be so readily explained. Health Department officials found it "startling and perplexing" that abnormal levels of the radioactive isotope cesium 137 were present at one location, in an area directly behind the site of the 99th Street School<sup>278</sup>. [See figure 4]. The school, it will be recalled, had been constructed on land adjacent to the original Canal excavation. The cesium 137 found near the school was not, health officials concluded, the product of weapons test fallout. If the cesium 137 in the Canal were from fallout, it would be expected that strontium 90, another fission product from fallout would also be present in the Canal, "associated with cesium" in a known, fixed proportion (approximately 1:1.5). Oddly, strontium 90 was not found in the Canal in the anticipated proportions.<sup>279</sup>

Moreover, the manner in which the cesium appeared in the soil was unusual. The soil borings from the spot in which the cesium concentrations were identified showed that this soil was markedly different in composition from any of the other Love Canal samples which had been analyzed.<sup>280</sup> Consisting of grass, topsoil and heavy in humus content, it was unlike the soil covering the rest of the Canal.<sup>281</sup> It was also unusual that the highest cesium concentrations were found at surface level, with concentrations decreasing with soil depth. It was probable, testified Dr. John Matuszek, the State's Director of Radiological Health, that the cesium which had been detected was not buried deep within the Canal, but may have been part of covering soil brought to Love Canal at a later time.<sup>282</sup>

The presence of cesium 137 in the Canal, unsupported by other radioactive materials, posed an intriguing question--where did it come from and who put it there? Dr. Matuszek testified at the Public Hearing that he had in fact never encountered unsupported cesium sources in "normal environmental areas open to the public" such as Love Canal.<sup>283</sup> In light of its unique nature and uses, the cesium was unlikely to have been utilized or generated by Hooker in its work or by any of the other chemical companies in the area. Its most likely source, Dr. Matuszek speculated, was a regional atomic research facility, which after fissioning either uranium or plutonium, had separated the cesium produced, used the cesium in an experimental program, and then discarded it as waste.<sup>284</sup> That, testified Dr. Matuszek, was "the only mechanism by which it would have gotten into the Love

Canal."<sup>285</sup> The Health Department did not pursue the question. Having determined that no health hazard was presented by the cesium 137 found in the Canal, it concluded its investigation without identifying the cesium's source.

#### Cesium Contamination Also Discovered Throughout the LOOW

Perhaps the most likely source for the cesium found in the Canal is the Knolls Atomic Power Laboratories ("KAPL"), and located in Schenectady, N.Y., a Navy/DOE facility operated by the General Electric Co. This facility had numerous contracts with the U.S. Atomic Energy Commission and the U.S. Navy in the early 1950's and most importantly, was known to have stored and disposed of radioactive materials and wastes at the AEC's storage area on the LOOW site. Significantly, cesium 137 has since been detected in various sections of the LOOW site by radiological surveys conducted in 1970 and 1979.<sup>286</sup> Further testing in the summer of 1980 disclosed that cesium contamination was even more widespread throughout the LOOW site than had previously been believed.<sup>287</sup>

Another source of cesium waste disposed of at the LOOW was the Raytheon Manufacturing Co. A letter from Raytheon to an AEC supervisor at LOOW forewarned that on October 4, 1949, "two boxes containing 126 Cesium Gaps" were being shipped to the LOOW site by Railway Express.<sup>288</sup> A February 5, 1949 memorandum from AEC's Medical Division to the LOOW area manager, entitled "Disposal of Useless Gaps" noted that "model 1 and model 2" gaps contain strontium 90 and model 3 gaps contain cesium 137. Burial or

temporary storage of these materials at LOOW had been approved, the memorandum noted, because the quantities involved were "small" and would "not present a serious external radiation or contamination hazard".<sup>289</sup> A 1954 survey by AEC of the LOOW site disclosed the presence of cesium gaps in drums and "loosely strewn on the ground" in the Castle Garden dump area of the LOOW, and in the Rochester burial area. Since these gaps and other materials were deemed a "definite radiation hazard" it was recommended that they be removed from the area.<sup>290</sup> A 1980 Department of Energy review of "resurvey requirements" for the LOOW revealed that cesium gaps measuring 10 milliroentgens/ hour remained at both of the above mentioned locations.<sup>291</sup> The Task Force is presently attempting to determine the nature of the materials described as "cesium gaps" and whether these wastes might have accounted for the cesium detected at Love Canal.

#### The Top-Soil Hypothesis and the Location of Cesium Atop Chemical Pits

Dr. Matuszek's provocative hypothesis, that the cesium found at Love Canal was brought there in "foreign" top soil was explored by the Task Force through the Public Hearing testimony of Carl Wagner. Mr. Wagner was the owner of an independent trucking firm in Niagara Falls that had performed various types of work for Hooker at the Love Canal site in the late 1940's and 1950's, including the hauling of chemical wastes to the dump, the excavation of pits at the site, and the burial of wastes.<sup>292</sup>

Confirming the accounts of others, Wagner testified that on either side of the Canal excavation, he and other contractors had



at Hooker's direction dug holes which were used for the disposal of waste drums from Hooker plants.<sup>293</sup> Although Wagner did not recall the digging of any holes directly behind the 99th Street School,<sup>294</sup> the minutes of the Niagara Falls Board of Education and related documents evidence that two large chemical "pits" had been discovered during construction of the 99th Street School in the area where the school's kindergarten play area had originally been planned. This discovery ultimately forced the relocation of the school site 85 feet to the north.<sup>295</sup> It was in the same area that these chemical pits were located that the Health Department had detected cesium 137. Consistent with Dr. Matuszek's theory, it was thus conceivable that the cesium in the Canal area had been brought there in contaminated soil used to cover the pits after they were filled in with chemical wastes. If this were true, however, Carl Wagner had no knowledge of it. He testified that the "holes" he had excavated were covered with the same soil that was dug out of the hole.<sup>295a</sup>

#### Summary

From all of this, no simple conclusion can be drawn. The parallel presence of cesium contamination at Love Canal and at DOE's Niagara Falls Storage Site is intriguing. At the very least, the "cesium fingerprint" discovered in Love Canal provides strong circumstantial evidence of the improper disposal of radioactive waste which likely originated from government-sponsored research or production activity.

C. THE FEDERAL GOVERNMENT'S SHARE OF RESPONSIBILITY  
FOR LOVE CANAL

The preceding discussion broadly outlines the extent of Federal Government involvement in the toxic contamination of Love Canal. Several key facts upon which a theory of federal responsibility may rest have been established. First, the Task Force found that military personnel were indeed directly implicated in the disposal of wastes into Love Canal in the 1942 through 1953 period. To this effect, thirteen individuals have stated in interviews, affidavits or sworn testimony that they witnessed Army personnel dumping drums at Love Canal or recalled military-type disposal activities in the area. Second, in the 1942-1953 time period, several government-owned, equipped or financed chemical manufacturing plants in the Niagara Falls area were known to have generated chemical and hazardous wastes which were disposed of in Love Canal either by Army or civilian personnel. Third, production statistics from these plants and the testimony and statements of military and civilian personnel involved in their operation indicate that substantial quantities of drummed chemical wastes were generated by these facilities. Further development and investigation of these facts is clearly warranted. This can perhaps best be accomplished in the context of the pending federal and state litigations involving Love Canal, as well as through the numerous claims recently filed by area residents pursuant to the Federal Tort Claims Act against the United States Army.

## Joint And Several Liability

The Federal Government's legal responsibility for its contribution to the toxic contamination of Love Canal is for a court, not this Task Force, to decide. The extent of federal liability for the acts described herein, it should be noted, may be equal to, or in fact be substantially greater than the proportionate share of the government-related wastes which were disposed of in the Canal. This Report has shown that there were several contributors, both from private industry and government, who were involved in the contamination of Love Canal. It is difficult, if not impossible, to determine with precision individual responsibility for the injury-causing effects of the dumping activities that have been documented. It is well established in prior cases that where the harm produced is incapable of any logical, reasonable or practical division, the contributing tortfeasors may each be liable for the entire injury that has resulted.<sup>296</sup> This legal theory has not yet been tested in the context of a toxic waste contamination litigation. However, legal precedent in various jurisdictions, including New York, based on common law principles established in analogous factual situations, holds that where the tortious acts of two or more wrongdoers join to produce a single, indivisible injury, each of the wrongdoers will be held jointly and severally liable for the damages sustained.<sup>297</sup> Thus, the Army's involvement in dumping at Love Canal could give rise to joint and several liability on the part of the Federal Government for the injuries proven to have resulted from the use of Love Canal as a disposal site.

## Liability for Acts of Government Contractors

The direct involvement of supervised Army personnel in dumping wastes at Love Canal establishes the clearest and strongest case for federal liability. No less important, but somewhat more complex, is the question of whether the federal government is also legally responsible for the disposal activities at Love Canal of government contractors such as Hooker, who operated several government-owned, equipped or financed chemical manufacturing plants and independently disposed of chemical wastes generated in the course of government production contracts. Although much depends on the nature of the government-contractor relationship, as shall be discussed below, legal responsibility for the proper disposition of wastes does not hinge solely on the identity of the waste hauler.

### Does the Independent Contractor "Liability Shield" Legitimately Apply?

A threshold question requiring determination is whether the relationship between the government and its contractor is that of "master-servant" or employer-independent contractor. The term "independent contractor" has been commonly defined as "one who, in exercising an independent employment, contracts to do certain work according to his own methods, and without being subject to the control of his employer, except as to the product or result of his work."<sup>298</sup> The distinction between an independent contractor and a "servant" (employee) has particular legal significance in the context of employer liability. The traditional and oft-applied rule is that, with some important

exceptions, the employer is not liable for the personal injury or property damage caused by the negligence or wrongful act of the independent contractor or his employees.<sup>299</sup> The theory behind this principle is that since the employer has no control over the contractor or his employees, he should not be responsible for their negligence. Numerous factual indicia have been developed in case law which can be used to determine the nature of the relationship. The labels applied by the parties to their relationship do not control. It is said that the most important test is "who has the right to control the manner of doing the work."<sup>300</sup> Other factors include whether the employer has the right to supervise the performance of the work, or to control workmen, or is obligated to furnish workmen or equipment.<sup>301</sup>

Described in this report are various factual situations involving different types of working relationships between the government and its contractors. In its operation of the P-45 plant for MED, Hooker described itself as an "agent" of CWS, not as an independent contractor. In contrast, when both duPont and Hooker operated the Niagara Falls Chemical Warfare Plant for the CWS, they did so ostensibly as independent contractors. However, the NFCWP was Army-financed, built and equipped, and was in fact commanded by an Army officer. Other officers stationed at the plant helped to supervise its operation and to insure that the finished product met CWS specifications. The process for manufacturing impregnite was in fact developed not by duPont or Hooker, but by the CWS. Moreover, throughout its history of operation, the NFCWP was regarded by the CWS as a government, not

a private facility. Similarly, the thionyl chloride plant operated by Hooker was a "designated" CWS facility.

The dodecyl mercaptan plant operated by Hooker for the federal Rubber Reserve Company presents a distinct factual situation. Here, Hooker operated the plant independently, pursuant to a Hooker-developed process. Hooker's entire DDM production during the war years, however, went directly to the Federal Government.

Resolving the question of whether there exists a master-servant or independent contractor relationship only begins the inquiry. The general rule of nonliability of the employer for the negligence of an independent contractor has numerous exceptions, several of which may be pertinent to the contractor activities described herein. For example, the employer may be liable where it is shown that he failed to hire a competent or responsible contractor,<sup>302</sup> where the employer ratifies or concurs in the particular acts of the contractor causing the injury,<sup>303</sup> where the work contracted for is unlawful<sup>304</sup> or creates a public nuisance,<sup>305</sup> or where the work to be performed is itself "inherently or intrinsically dangerous."<sup>306</sup> The latter two exceptions to the general rule of nonliability bear closer attention.

#### Inherently Dangerous Work

The "inherently dangerous work" exception is premised on the theory that a person who engages a contractor to do work of an "intrinsically dangerous" nature "remains subject to an absolute, non-delegable duty" to see that the work is performed with the

degree of care that is appropriate to the circumstances.<sup>307</sup> Although the term "inherently dangerous work" is frequently defined as "work necessarily attended with danger, no matter how carefully it is performed,"<sup>308</sup> there is a wide divergence in the case law in the interpretation and application of this definition. It is clear that the inherent danger must be a trait of the assigned work itself and not arise from the negligent manner in which the contractor elects to perform an essentially nonhazardous detail of the work.<sup>309</sup> One distillation of this exception is to impose liability on the employer "where the work is of such nature as, under the general law of negligence, to require the exercise of a "high degree of care."<sup>310</sup>

Although no court has explicitly decided the question, a contractor's operation of a chemical manufacturing plant and its disposal of toxic and hazardous substances generated in the course of the production process could well qualify as "inherently dangerous work." Thus, if a contractor's disposal activities are deemed to be unlawful or negligently performed, the employer could be held liable for the acts of its "independent contractor." Government liability for the Love Canal disposal activities of Hooker and possibly other contractors could rest in part on this theory.

A strong argument can be made that the rationale for holding the government liable for injuries resulting from the negligent disposal of chemical wastes from government-related chemical production is consistent with the basic policy behind the "inherently dangerous work exception." The underlying theory is

that the government cannot evade responsibility for injuries arising from its hazardous chemical production and related activities (while reaping the benefits) by delegating the performance of those activities to a third party and ignoring its responsibility to insure that all reasonable precautions are taken during the performance of dangerous work to protect third parties from injury.

#### Creation of a Nuisance

Another exception to the general rule of employer nonliability is where the work performed by the independent contractor necessarily involves the creation of a "nuisance." The basis for employer liability in this instance rests on the fact that the employer knows or has reason to know that his contractor will likely, in the ordinary course of doing the work in the usual or prescribed manner, create a nuisance.<sup>311</sup> If a court determines that Hooker's conduct and disposal activities at Love Canal have created a nuisance, this exception may provide an additional ground for government liability. To date, there is no concrete indication that CWS or other Army officials had actual knowledge of Hooker's disposal methods and activities at Love Canal. However, there is evidence to suggest that Army personnel had reason to know of these activities and their likely results, both from the nature of the prescribed work and the specifications that CWS prescribed for the work. It will be recalled that the operating manual for the NFCWP, prepared at the CWS's direction, explicitly stated that the highly toxic wastes generated at the plant were to be sent to "the dump" in iron



drums, and buried. Thus knowledge that government-related chemical production activities would have waste production and disposal ramifications was inescapable.

In conclusion, both the "inherently dangerous work" and "nuisance" exceptions to the general rule of employer liability may be applicable in determining the extent of federal liability for the disposal activities of government contractors at Love Canal.

## FINDING II

THE ARMY'S 1978 INVESTIGATION AND REPORT DID NOT ADEQUATELY EXAMINE THE ISSUE OF ARMY INVOLVEMENT AT LOVE CANAL

At the conclusion of the Army's investigation into alleged Army dumping at Love Canal, Deputy Assistant Secretary of Defense for Energy, Environment and Safety George Marienthal stated to the Niagara Gazette:

"We've taken a look at everything we can and we've been unable to verify even a hint of evidence that there was Army dumping at that site."<sup>1</sup>

Although perhaps intended to alleviate the fears of area residents, this seemingly authoritative public pronouncement did not precisely accord with the actual conclusions of Army investigators. Their findings, incorporated in the August 14 Report<sup>2</sup> were somewhat more ambiguous, as an Army counsel who had helped draft the Report later explained to members of the Task Force:

"[The August 14 Report] concluded that we found no evidence to corroborate the allegations of Ventry or Downs."

"It also concludes, however, that waste generated by Hooker in the performance of contracts for the Army may have been placed in the Love Canal, as part of Hooker's procedures."<sup>3</sup>

In a similar tentative tone, the Army's August 14 Report concluded:

"The Army investigation found no evidence of direct Army involvement in the Love Canal site....Wastes generated by...Hooker...in performance of contracts for the Army may have been placed in the Love Canal site as part of Hooker procedures; but [there was no finding] of direct Army involvement in any such dumping."<sup>4</sup>

The carefully crafted wording of the August 14 Report reflected the legal tightrope onto which the Army had stepped. The Army apparently believed it could avoid legal liability so long as the evidence did not show that Army personnel themselves disposed of wastes in Love Canal. Thus, the Report quietly conceded the likelihood that wastes from an Army plant and Army-related facilities contributed to Love Canal's chemical waste pile, although it steadfastly denied responsibility for the consequences of the disposal of those wastes.

It is revealing to contrast the Army Report's actual findings and conclusions with their public presentation by the Army. The ambiguity and the cryptic language found in the Report were gone. Rather, the public was assured by Mr. Marienthal that not even a verifiable "hint of evidence" of Army involvement at Love Canal could be found. Two years later, in testifying before the Senate Subcommittee on Health, Mr. Marienthal reaffirmed this characterization of the Report's conclusions. There was, said the Deputy Assistant Secretary of Defense, "no basis in [Ventry's] allegations; in fact, there was no evidence that the Department of the Army had dumped into Love Canal."<sup>5</sup> Testifying before the Task Force, the Army counsel involved in the investigation offered a slightly different version, observing:

"We did not intend to conclude that Ventry was necessarily wrong. What we had intended to conclude was that we found no evidence to support his allegations. There may well have been an isolated document which would explain his entries or observations. We--you can never prove the negative. It is impossible to do. We cannot say what Ventry said happened, did not happen. Our report does indicate that we were unable, in 1978, to find anything to support it...."

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"It was not intended to say that those activities never did happen."<sup>6</sup>

These divergent interpretations aside, the ultimate effect of the Army's investigation and Report was to quell public suspicion and whether intended or not to dampen further investigative efforts. The key question explored here is how hard and how well did Army investigators search for evidence that might have corroborated or explained the eyewitness allegations.

A. THE IMPACT OF THE NARROW SCOPE OF THE ARMY INVESTIGATION AND THE BREVITY OF THE INVESTIGATION PERIOD.

Events moved quickly after the first eyewitness allegations of Army dumping at Love Canal were made in late May 1978. Almost immediately, Congressman John LaFalce, 36th C.D., requested that the Department of Defense ("DOD") conduct an investigation. A cursory DOD record search was quickly completed but its inadequacies prompted Congressman LaFalce to demand a "more vigorous investigation".<sup>7</sup> On July 7, 1978, the Army directed that a more intensive investigative effort be conducted under the auspices of a Board of Officers, an appointed panel of Army officers and expert civilians, whose assignment was to "investigate fully the allegations concerning the alleged dumping of toxic substances in Love Canal."<sup>8</sup>

The Army's Three Week Investigation

In a period of one week, from July 7 through July 15, Army personnel "searched" the "available records concerning Army-related chemical activities in the Niagara Falls area."<sup>9</sup> This entailed document searches at six federal record centers, as

well as a review of the historical files in the Niagara Falls Library.<sup>10</sup> In a subsequent nine-day period, thirty-eight interviews were conducted, including interviews with the two eyewitnesses, local, state and federal officials, and representatives of private chemical companies. By July 27, the Army Board of Officers had completed its 27-page report of the investigation, and reviewed the hundreds of pages of exhibits attached to the report.<sup>11</sup> The investigation's findings were explained to Congressman LaFalce by Army and DOD officials on August 4. Subsequently, Army counsel and staff prepared the August 14 Report, a summary version of the Board of Officers Report.

Perhaps the most striking feature of the Army's investigative effort was the speed and efficiency with which it was conducted. The expeditious handling of the probe was due in part to the perception of Army investigators that Congressman LaFalce, or someone in the chain of command, had set an inviolable deadline for the entire project.<sup>12</sup> Striving to meet this deadline, Army investigators labored at a hectic pace, working "seven days a week, fourteen to sixteen hours a day."<sup>13</sup> In light of the magnitude of the task, a one-week extension of the deadline was procured. However, as the Task Force's own inquiry evidenced, the research and investigative task was too extensive to be thoroughly completed in three weeks, even with the preliminary work that had been done by the Army in late May and June. Too many factually cloudy issues had to be resolved, in too short a time. The unrealistic time schedule caused

peripheral issues which were legitimately raised in the course of the Army's investigation, such as the disposition of impregnate after the war, to remain unexplored. If, as advertised, the Army investigation was to look at all Army activities in the region, an extensive document study was required. Although the Army reviewed many pertinent records, the time period allotted for the investigation was insufficient to accomplish its objectives. Consequently, significant caches of documents were either never found or were simply ignored.

#### Records Missed By the Army

There is no indication that Army investigators reviewed or even identified the records of the Chemical Warfare Service located at the National Federal Records Center, the records of the Army's "Manhattan Engineering District" located at DOE's archives in Oak Ridge, or the records of the Reconstruction Finance Corp. and War Production Board located at the National Archives in Washington.

Chemical Warfare Service historical records at the Edgewood Arsenal were reviewed by the Army, but their investigators inexplicably either overlooked, ignored, or did not deem significant documents discussing several pertinent factual issues, including the actual amounts of drummed waste resulting from the production of impregnate at the Army's Niagara Falls plant,<sup>14</sup> the storage of impregnate at the Northeast Chemical Warfare Depot,<sup>15</sup> and the disposal of surplus impregnate as outlined in the Chemical Corps 1948 manual.<sup>16</sup> One Army representative captured perfectly the time-pressured investigative philosophy:

"Now, it may be that some records were missed, but we would probably still be looking at the problem if we tried to look at every conceivable record."<sup>17</sup>

#### New Eyewitnesses Not Sought Out

Unfortunately, the same hectic, haphazard methodology marked the nine-day "interview" segment of the Army's investigation. No effort whatsoever was made to seek out additional eyewitnesses or to interview knowledgeable area residents. In this manner, the Army might have corroborated the accounts of Messrs. Ventry and Downs. The identification of new eyewitnesses was not, as the Task Force's investigation proved, an impossible task. It did require time, however. The Army's investigative emphasis, it seemed, was not on uncovering new evidence, but on refuting the old. Only persons who were "known" and "knowable", as an Army counsel described it, were sought out.<sup>18</sup> This lack of initiative could possibly be explained by the perceived deadline for the inquiry. Unless a source actively arrived on the Army's doorstep, it was unlikely to be found:

"We investigated anything which was brought to our attention. We would have been willing to receive whatever evidence, eyewitness testimony that people would have through officials, through private persons. We did not go out and publish a notice, saying that the Army was investigating the possible contamination of Love Canal."<sup>19</sup>

#### Known Sources Not Interviewed

However, not even all persons "known" and "knowable" were in fact interviewed during the 1978 investigation. William O'Connor, the former duPont employee whose name and address were actually supplied to the Army late in the investigation by another interviewee,<sup>20</sup> was never contacted. O'Connor's knowledge

of NFCWP operations and his recollection that Army trucks at the NFCWP were used for hauling chemical wastes from the plant proved most interesting, despite (or because of) its inconsistency with the Army finding that no Army trucks were ever stationed at the NFCWP.

In addition, many of the Army personnel stationed in the Niagara Falls region in the 1940's, whose names were known to Army investigators or could have been ascertained by close review of Army documents, were not located or sought out by Army investigators. With the exception of the reported interviews with Arnold Arch and Joseph Finster, the Army Report does not indicate whether any attempt was made to interview other officers at the NFCWP or to determine if they were deceased.<sup>21</sup> The names of Major Homer Deschanes, and Lt. Col. E.J. Thomas, who commanded CWS's Northeast Chemical Warfare Depot, appear repeatedly in old Army documents,<sup>22</sup> but no attempt to locate or interview them is noted.

#### B. FACTUAL INACCURACIES AND OMISSIONS

The Army's August 14 Report contained several factual misstatements and omissions which bear on the investigative efforts's ultimate credibility.

##### Error as to Date of Love Canal Use

Perhaps the most glaring error was the preconception of Army investigators, apparently derived from information provided by Hooker representatives,<sup>23</sup> that Love Canal use began in 1947, rather than in 1942. Premised on this factual assumption, the Army's investigation focused primarily on documents and events



occurring subsequent to 1947. Although Army investigators later claimed that in the course of their review, they also examined pre-1947 activities and documents,<sup>24</sup> the August 14 Report speaks louder: "products and wastes generated prior to 1947 or after 1953," the Report stated, "are generally irrelevant to the contamination of Love Canal."<sup>25</sup> Whether the documents from the 1942-1947 period were scrutinized by the Army investigators as carefully as documents from the later period cannot be definitively answered. In testimony before the Task Force, the investigation's post-1947 emphasis was conceded:

"I think it is important to note that in the task document that came to us, we were basically requested to respond to the allegations that had been made with regard to Army dumping, and unless I am mistaken, those allegations were from 1947 to 1951, or something of that sort."<sup>26</sup>

#### Production of Phosgene for CWS

The date of Love Canal use was not the only factual issue as to which Hooker representatives inadvertently misled Army investigators. Hooker also supplied the Army with erroneous information concerning wartime production of phosgene (carbonyl chloride), a substance used both commercially and as a lethal chemical warfare gas. The question of phosgene production and its incident waste disposal loomed as a potentially significant and publicly sensitive one, in light of the operation by Oldbury Electrochemical during World War One of a phosgene plant in Niagara Falls. Although it is unclear whether this information was based on production documents or an employee's recollection, Hooker represented to the Army that it had produced phosgene, possibly for the Army, but only "on a small scale for industrial

research and development purposes."<sup>27</sup> Army investigators failed to confirm this information with a second source stating in their Report:

"The [Oldbury] plant has not produced phosgene for the Army since World War I and the Army investigators found no evidence that any other chemical warfare type agents were produced for the Army at the plant or<sub>2</sub> elsewhere in the Niagara Falls area since World War I."<sup>28</sup>

Both the Army and Hooker were dead wrong. Records reviewed by the Task Force from the War Production Board (Record Group 179), which can be found at the National Archives in Washington, D.C., proved conclusively that phosgene was manufactured in significant quantities in the Niagara Falls region, both at Hooker and at Niagara Chlorine's plant in nearby Lockport. In 1943, Hooker's plant produced 274,000 pounds of phosgene, with similar amounts estimated for 1944 and 1945.<sup>29</sup> The Niagara Chlorine facility produced phosgene in substantially larger quantities -- 2,223,000 pounds in 1943 alone.<sup>30</sup> The phosgene produced by these two companies was used by the Chemical Warfare Service, Navy Ordnance, and our allies, as well as for dyestuffs, resin and other miscellaneous purposes.<sup>31</sup>

Army investigators did not review the records of the War Production Board, which would have clearly shown them that phosgene had been produced in the Niagara Falls region. In discussing the issue with the Task Force, Army investigators conceded the Report's error concerning phosgene, but incredibly, continued to maintain that only the Niagara Chlorine plant and not Hooker had produced phosgene.<sup>32</sup>

The fact that phosgene was produced in the Region must be viewed in its proper perspective. There is no evidence to suggest that phosgene or its waste products were disposed of in Love Canal or even figured prominently in Hooker's chemical production during the war. While buried phosgene cylinders were discovered in 1970 at the Lake Ontario Ordnance Works site, it is not known when or by whom these cylinders were disposed. The Army's phosgene production error is significant because it reflects on the exhaustiveness and accuracy of the Army investigation. Although the Report claimed that a comprehensive examination of "the chemical operations of the Army and its contractors in the Niagara Falls area"<sup>33</sup> had been completed, the Army's failure to correctly report the production of phosgene suggests some serious flaw in either the Army's investigative methodology or its execution.

#### Army Ignores MED Records and Activities

Army investigators elected not to explore the wide-ranging activities in the Region of a crucially important Army unit, the Manhattan Engineering District. Since the Department of Energy and not the Army was the custodians of MED's voluminous records, review of these records was apparently not perceived as the Army's institutional responsibility. Thus, after interviewing one veteran MED/AEC official who denied any knowledge of Army dumping at Love Canal,<sup>34</sup> Army investigators were quite content to ignore MED activities. As the result of this narrow focus of the Army investigation, several important MED and government-related facilities, including the uranium processing plants operated by

Electromet and Linde Air Products, were not scrutinized by Army investigators. The Board of Officers, apparently aware of this gap in their research, did include a recommendation in their report recommending that the Department of Energy review MED and AEC "disposal activities in the Love Canal, if any."<sup>35</sup> However, DOE had not, at least prior to the Task Force's Freedom of Information Act request, reviewed the hundreds of boxes of Manhattan Project documents pertinent to MED activities in the Region.

#### Knowledge of Government Officials Concerning Waste Disposal

The Army investigation ultimately concluded that no evidence could be found of "direct Army involvement" in dumping at Love Canal. Indirect involvement in Love Canal contamination could not be disclaimed however, since the Army conceded that wastes generated "by Hooker" in performance of Army contracts "may have been placed in the Love Canal site as part of Hooker procedures."<sup>36</sup> In the August 14 Report, the Army actively sought to ward off any perception of federal liability for Love Canal, twice asserting its legal position that the Army bore no responsibility for the disposition of wastes from "private chemical operations which were Army procurement related."<sup>37</sup> Ultimate responsibility for the disposal of wastes from the Niagara Falls Chemical Warfare plant was neither explicitly denied nor assumed.

The Army's perception of its legal liability may have influenced its fact finding. In the belief that the Army was responsible solely for those wastes directly dumped at Love Canal

by Army personnel, the investigation side-stepped a critical factual and legal question--whether any responsible Army or government officials had knowledge or reason to know of the manner in which Army chemical wastes were disposed of by Army contractors during this time period. The Task Force's investigation revealed that the relationship between the Army and its private contractors was far closer than the Army's Report made it appear. For example, the plants operated by Hooker for the production of thionyl chloride and hexachloroethane were considered by Hooker to be Chemical Warfare Service plants. Equipment in other Hooker operated plants was provided or paid for by CWS. The NFCWP and the "P-45" facility, built and paid for by the Army, were in every sense government and not private facilities. Moreover, the operation of these plants was directly supervised and observed by Army officers. However, since Army investigators did not systematically seek to locate and interview the majority of former Army personnel, the issue of whether they were aware of how and where their plants' wastes were being disposed was never explored.

#### Summary

The Army's investigation failed to fulfill its principal mission. It did not conclusively resolve the question of whether the Army or other federal agencies were responsible, at least in part, for the contamination of Love Canal. There are a sufficient number of factual errors, omissions and misconceptions in the Report to warrant a reopening of the Army's investigation. While the Army's investigation may have been undertaken with good

intentions, it was seriously hampered by the unreasonable deadline set for the inquiry, its narrowly defined scope, and the seeming acceptance of a pervasive presumption that the alleged dumping incidents were isolated and probably unexplainable. Army energies should have been devoted, regardless of the time it took, to explaining the events which the witnesses alleged had occurred. The publication of the accounts of new eyewitnesses mandates that such an intensive study be conducted.

FINDING III

THE ARMY'S "MANHATTAN PROJECT" DISPOSED OF 37 MILLION GALLONS OF RADIOACTIVELY CONTAMINATED CHEMICAL WASTES IN UNDERGROUND WELLS WHICH THE FEDERAL GOVERNMENT HAS TO DATE NEITHER MONITORED NOR IDENTIFIED IN ANY OF ITS SURVEYS.

INTRODUCTION

The Task Force's review of the Manhattan Engineering District ("MED") historical archives disclosed that shallow underground wells located beneath the Linde Air Products Co. site in Tonawanda, N.Y. were used by MED in 1944 through 1946 to dispose of over 37 million gallons of radioactively contaminated liquid chemical wastes. These highly caustic liquid wastes emanated from the first stage of a uranium refining process which Linde operated for MED at its "Ceramics Plant", under MED's direct supervision. MED officials, all Army personnel, were intimately involved in the decision-making regarding the disposal of these liquid wastes. The documents evidence that both Linde and MED officials were aware that this method of disposal would permanently contaminate Linde's wells and probably the wells of Linde's neighbors in the surrounding region. In fact, this method of disposal was selected precisely because the source of the underground contamination could not readily be traced back to Linde or the Army.

The present environmental impact of the chemical and radioactive contamination caused by the disposal of liquid wastes from the Linde plant (now part of Union Carbide, Linde Division)

cannot be assessed by the Task Force. The caustic effluent, containing only a relatively small proportion of uranium oxide, may have been sufficiently diluted underground so that it does not pose a present health hazard. It is distressing, however, that both the Army and the Department of Energy, despite their much vaunted "remedial action programs" have never identified the location of the wells or even indicated knowledge of their use by MED and Linde. No analysis or monitoring of the Linde wells or of related chemical contamination in the surrounding ground and well water is known to have been conducted to date. The very existence of the Linde wells seems to have slipped through some crack in the bureaucratic structure to evade detection.

The extended discussion which follows concerning the origin and use of the Linde wells is based on the records obtained through the Task Force's FOIA request to the United States Department of Energy. Reviewed in chronological perspective, these documents provide a fascinating "micro-history" illustrating the manner in which Manhattan Project policies regarding the problem of waste disposal were executed in the Niagara Frontier region. The classic ingredients are all present here -- the continued use of untried methods and primitive technology until the threat of financial and environmental ruin became a reality; the pressing demand for uninterrupted production, at any cost; and, at every stage, the tightening of the purse strings when it came to providing adequate funds for safe disposal. The impact of these policies is not yet fully known. How they influenced one plant's operations, in connection with one federal project, is described below.



#### A. HISTORY OF THE LINDE MED CERAMICS PLANT OPERATIONS

In June 1942, President Roosevelt authorized the continuation of atomic energy research and development work, including the immediate design and construction of production plants that would provide materials necessary for "atomic fission bombs."<sup>1</sup> This "feed materials" project was one of several programs implemented by the Manhattan Engineering District ("MED"), an Army unit under Corps of Engineers jurisdiction and the principal agency involved in the development of the atomic bomb.<sup>2</sup> The objective of the program, which was to become one of MED's top priorities, was to procure huge amounts of uranium-bearing ores and convert them through various refinement stages into feed materials for the processing plants.<sup>3</sup>

The Linde Air Products Co., located in Tonawanda, N.Y. [see Figure 6], operated one of the program's principal refining plants. Linde was selected because of the expertise it had acquired from its work in the ceramics business, in which it processed uranium to produce the black, yellow, green and brown "salts" used for the coloring of ceramic glazes.<sup>4</sup>

Linde's federal contract<sup>5</sup> called for it to operate a plant built and financed by MED that would refine both American and African uranium-bearing raw ores in a series of three consecutive steps. Step I produced a black oxide (uranium oxide,  $U_3O_8$ )<sup>6</sup>; Step II a brown oxide (uranium dioxide,  $UO_2$ ); and Step III a "green salt" (uranium tetrafluoride,  $UF_4$ )<sup>7</sup> which was then shipped to Electrometallurgical Co. in Niagara Falls to be chemically processed into uranium metal. The refining of black oxide, Step

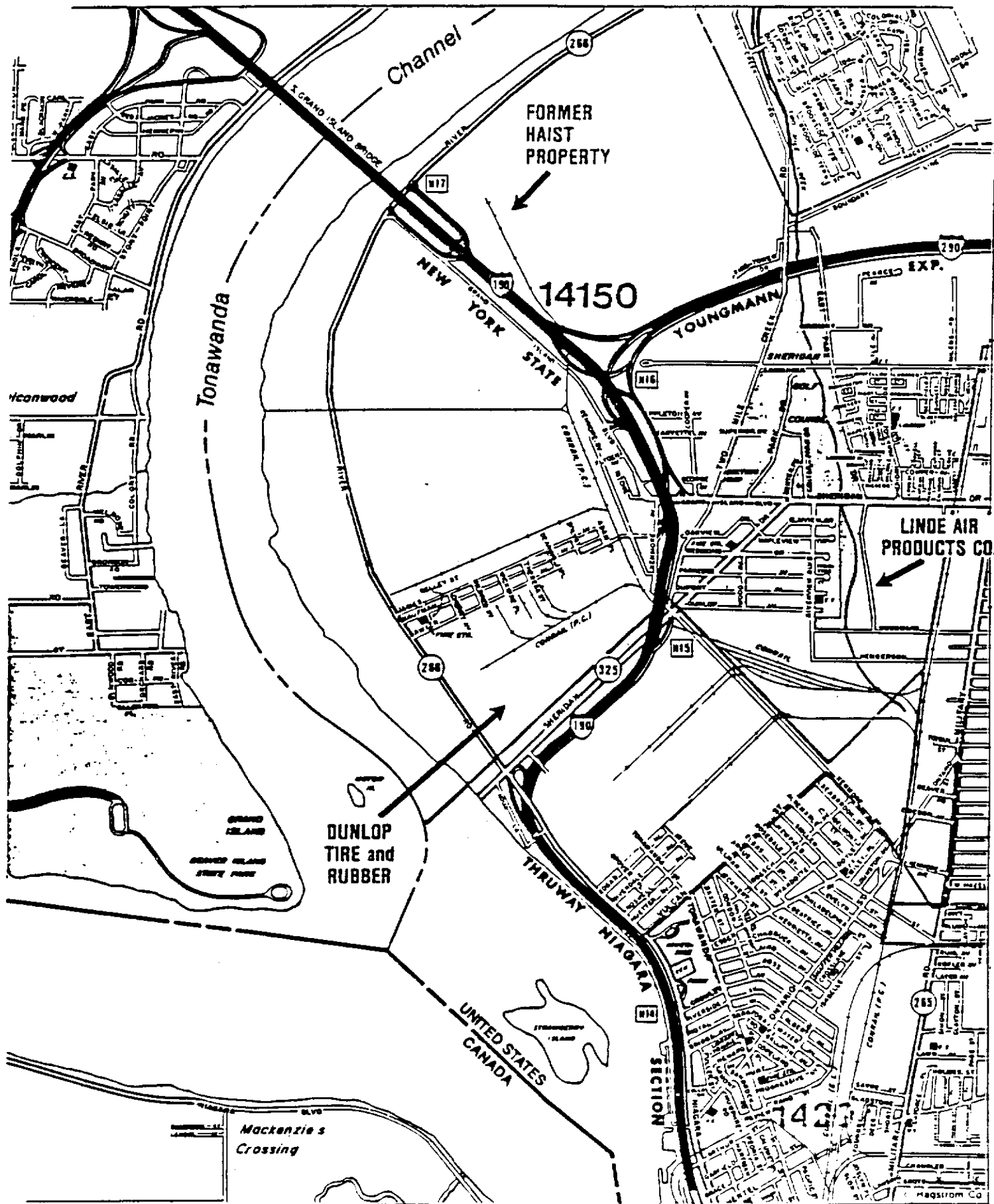


FIGURE 6 - Tonawanda Area

I, began at Linde in July 1943 and continued until the supply of low grade uranium ore became unavailable in mid-July 1946. By that time, the plant had produced 2,248 tons (4,856,000 pounds) of black oxide. It had also generated significant quantities of radioactive wastes in the form of both liquids and semi-solids.

#### Disposal at Haist and LOOW of Linde Sludges

Sixteen million pounds of sludge-like uranium ore residues, containing .54 percent uranium, (from domestic ore) were generated by the Linde refining process and disposed of at a ten-acre site known as the "Haist Property". MED first leased the site in 1943, then purchased it in 1944. In 1960, the property was sold to the Ashland Petroleum Company, which constructed an oil tank farm over the disposal area<sup>8</sup>. A 1976 DOE radiological survey indicated the presence of low-level radioactive contamination in the soil which was deemed not to "pose an immediate health hazard" so long as the site's present limited use continued. The site's location in an industrial area of low population density, a later DOE study noted, put "few people at risk". However, the same study warned that if the site's use were changed or buildings constructed on-site, "there could be an increase in exposure and a potential health hazard could result."<sup>9</sup> DOE has concluded that some form of remedial action at the site may be required. In order to enjoy "unrestricted use" of the property, DOE's most stringent environmental standard, it was estimated that 48,000 cubic yards of soil would have to be removed.<sup>10</sup>

A separate problem is presented by the generation of uranium tailing residues from the higher grade African ores, which were processed at the Linde plant. Beginning in 1944, these sludges were transported by truck from the Linde Plant to the Lake Ontario Ordnance Works for storage in various structures there. These sludges were from the refining of a higher grade of ore containing a greater concentration of uranium than the ores whose residues were disposed at the Haist property. As discussed infra at 266, DOE is presently considering the ultimate manner of disposition of these residues. The problem is not inconsiderable--the U.S. Atomic Energy Commission estimated in 1953 that the sludges stored at LOOW and the Haist properties contained approximately 107,000 pounds of unrecovered uranium.<sup>11</sup>

#### Decontamination Required at Linde Plant

The site of the MED-Linde "Ceramics Plant" was itself theoretically decontaminated in June 1949, at a cost of \$53,000<sup>12</sup>, prior to sale of the facility to Linde. However, a DOE radiological survey performed in 1976 disclosed that surface contamination at two of the five Ceramics Plant buildings remained "quite extensive" and was also present in two other buildings. DOE advised Linde that the contamination might represent a "potential radiation safety problem to personnel conducting maintenance or construction activities directly involving these surfaces."<sup>13</sup> DOE has estimated that remedial action, if it is required, would involve the removal of 72,000 cubic yards of soil and 19,000 cubic yards of building material.<sup>14</sup>

As the preceding discussion evidences, contamination at the Linde plant buildings and the disposal of radioactive sludges from Linde's MED operations have been given close attention by DOE. In contrast, although documents detailing operation of the Linde wells were part of the MED archives maintained by DOE, the impact of the plant's underground disposal of highly caustic radioactive liquid wastes has been ignored and the existence of the wells forgotten.<sup>15</sup>

## B. HISTORY OF USE OF UNDERGROUND WELLS FOR LIQUID WASTE

### DISPOSAL

#### Uranium Content of "Liquors"

In the course of producing black oxide, the Step I process generated large quantities of liquid radioactively contaminated chemical wastes. Emanating from a distillation process, the Step I liquid wastes, called "liquors", had to be carefully monitored since as the Step I Operating Manual cautioned:

"It was extremely important that the uranium content of the liquors be kept as low as possible to avoid high losses and a poor overall yield."<sup>15a</sup>

Linde was able to keep the uranium content of the liquors relatively low, with the concentration of uranium oxide ( $U_3O_8$ ) in the Step I effluent generally averaging .05% of the liquor's total volume.<sup>15b</sup> Since even this small percentage resulted in the loss of up to 3% of the uranium oxide produced, Linde researched means of altering their process to further reduce the amount of uranium lost.<sup>16</sup> In addition to  $U_3O_8$ , the caustic liquors consisted primarily of sodium sulfate with a small amount of sodium carbonate.<sup>17</sup>

Initially, the Step I liquors were discharged to the City of Tonawanda sanitary sewer system. Permission to use this method of disposal was predicated on a representation originally made by either Linde or MED that the pH of the effluent would average approximately 6.9 to 7. When Tonawanda sewer officials discovered that the pH of the liquors received from Linde was between 10.8 and 11, they demanded that the Step I effluent be properly neutralized, and threatened to prohibit Linde from using the sewer system if they were not.<sup>18</sup> City officials had discovered that the highly alkaline waste from the Ceramics Plant was killing the bacteria necessary to the sewage treatment plant's operations.<sup>19</sup> As a temporary solution, 16,000 pounds of sulfuric acid were used each day to neutralize the wastes at a daily cost of \$160.00.<sup>20</sup> However, the addition of sulfuric acid produced erratic results. At MED's request, Linde took readings of the effluent which showed that larger amounts of sulfuric acid, at even greater cost, were required in order to sufficiently neutralize the waste.<sup>21</sup>

While Linde and MED considered various alternative disposal methods for the liquors, dumping of the still highly alkaline wastes into the sewer system continued unabated through April 1944. Finally, the Superintendent of the Tonawanda Sewage Treatment Plant announced that he would "bulkhead" the Linde sanitary sewer entirely, affecting all Linde operations, unless the effluent flow was stopped.<sup>22</sup> The seriousness of this threat prompted Linde to immediately analyze the other available disposal alternatives:

1) to discharge the wastes into a storm [as opposed to sanitary] sewer which emptied into "Two Mile Creek". This stream ran through a public park and ultimately joined the Niagara River;

2) to pump the wastes into underground wells located on Linde's Plant #1 property, wells which had been originally drilled to supply cooling water for Linde machinery, but whose water was now deemed unfit for use.<sup>23</sup>

Ultimately, both of these disposal methods were utilized at various times.

#### The Advantage of Dumping Wastes into Underground Wells

The rationale behind the initial decision to use the underground wells, revealed in a remarkable and discerning series of correspondence between Linde and MED, merits particularly close review. In a March 29, 1944 letter to Captain Emery Van Horn, MED's Tonawanda Area Engineer (its chief regional officer), [see Appendix] Linde stated that dumping the wastes into the storm sewer system which drained into a nearby creek ("Plan I") was "objectionable because of probable future complications in the event of claims of contamination against us."<sup>24</sup> Linde's fear was that the discharge of Step I wastes in this obvious and crude manner might cause injury and give rise to clear-cut liability, particularly since the hot, caustic liquors would be flowing through a public park in which children frequently played.<sup>25</sup> Moreover, Linde's Law Department had ruled that dumping the wastes in this manner would be in violation of existing New York State regulations.<sup>25a</sup>

Linde strongly favored the pumping of the effluent into underground wells ("Plan 2") for one simple, but convincing reason -- it believed that the resultant underground toxic contamination could not readily be traced to the Linde Plant. In

requesting MED's permission to use the underground wells, Linde explained the principal advantage of Plan 2:

"our Law Department advises that it is considered impossible to determine the course of subterranean streams and, therefore, the responsibility for any contamination could not be fixed. Our Law Department recommends that this method of disposal be followed."<sup>26</sup>

Linde further asserted that the content of the liquors themselves were not harmful, a fact which Linde claimed had been attested to by local, state and federal officials:

"We understand that local representatives of the New York State Board of Health and of the Town of Tonawanda Filtration Plant have given the opinion that the effluent liquors are not detrimental to the public health. We also are told that Captain Ferry has expressed the opinion that there is nothing<sup>27</sup> in the effluent liquors detrimental to public health."

The self-contradiction inherent in Linde's analysis of the disposal alternatives is evident. If the Step 1 effluents truly were, as Linde represented, not "detrimental to public health", the fear of liability arising from their discharge into the wells would be groundless. Clearly, Linde recognized that contamination from discharge of the effluent would have a detrimental impact, since the choice of the well disposal method was made in order to evade liability. It is most disheartening that the use of underground wells was advised by Linde not because this method was safer or scientifically more sound but so that the source of contamination, the MED-owned, Linde-operated Ceramics Plant, could not readily be identified.

#### Knowledge of Local Officials Concerning Radioactive Content of Liquors

Also deserving of closer examination is the factual basis for Linde's assertion in its March 29 letter that federal and



state health officials did not consider the discharge of Step 1 wastes detrimental to public health. There is no indication in the documents reviewed by the Task Force that Tonawanda Sewer Plant officials or state health officials were informed that, in addition to being highly caustic, the wastes were contaminated by uranium oxide. The District Sanitary Engineer for the State Department of Health, the agency which allegedly approved discharge of the effluent into Two Mile Creek, referred to the Step 1 effluent only as "certain alkaline wastes". Wastes of this nature, the Engineer ruled, would "create no menace to health or condition of nuisance" if dumped into the creek.<sup>28</sup> It is more than likely, in light of what is known about MED's modus operandi in this secretive period, that neither state nor local officials were informed that the Step 1 liquors contained particles of uranium oxide. Their approval of a particular disposal method would be meaningless if it was in fact based on incomplete or deliberately misleading information. The failure to provide complete information concerning sensitive areas would accord with the pervasive MED policy of concealment regarding the secret mission of the Linde operation. In all probability, only the highest-ranking company officials would have been told that the ores being processed contained uranium.<sup>29</sup>

MED's tightfistedness regarding the disclosure of information related to its projects was illustrated in the instructions it gave Linde workers when they were told to wear film badges to measure their occupational exposure to radiation. To avoid "undue apprehension", the workers were not told that

they were being tested for exposure to uranium but only that the badge contained a "chemical or material with which to check on working conditions with regard to dust, chemicals or fumes...."<sup>30</sup> Furthermore, an attempt was apparently first made to pass the film badge off as a special identification "badge" required for all Step 1 workers.<sup>31</sup>

It is unclear whether workers were ever informed of the nature of the hazardous materials they were handling. For example, MED and Linde contracted with a local trucking company to haul radioactive sludges from Linde to LOOW and the Haist property. The truckers were directed to exercise special care in hauling the sludge and to use specially designed trucks to prevent spillage. However, they were apparently not told that the material they were transporting was radioactive, a fact which might have induced special caution on their part and deterred the sloppy handling that on occasion did occur.<sup>32</sup> The need for secrecy, given wartime conditions and the urgency of the Manhattan Project, was perhaps understandable. What is inexcusable, however, is that the cloak of secrecy seems to have been used to conceal pertinent, ostensibly non-secret information from those who had a "right to know".

At least one federal health official clearly knew that the Step I liquors contained a small percentage of uranium oxide. Captain John L. Ferry, a MED Medical Corps. officer reportedly informed Linde that "there is nothing in the effluent detrimental to public health."<sup>33</sup> Captain Ferry's medical opinion appeared in an April 10, 1944 memorandum to Captain Van Horn [see Appendix]

in which Ferry assessed solely the option of disposing the effluent into the storm sewer near the Ceramics Plant. Such storm sewer disposal, he concluded, "would present no hazard from the standpoint of the X material [uranium]<sup>34</sup> contained in the 150,000 gallons discharged daily.<sup>35</sup> However, none of the MED documents obtained reflect whether Capt. Ferry or any other state or local health official was ever asked to consider the impact of the disposal of Step I liquors in underground wells. This question remains open to this day.

MED officials were concerned about more than just uranium contamination with regard to disposal of the liquors. In considering the creek disposal method, Captain Ferry had noted in his memorandum that the "high pH and carbonate content of the effluent even diluted to 10 to 1 by the flow of the creek might be objected to by the local health authorities."<sup>36</sup> MED surmised that the authorities would not object to dumping the effluent in the creek, however, given the creek's already contaminated condition. Whether the discharge was in and of itself detrimental or injurious to public health was clearly not the critical issue. As Ferry observed:

"authorities consider the creek so heavily contaminated at present that no objection is raised to adding the material in question to it."<sup>37</sup>

#### MED "Permission" Requested for Underground Disposal

Although Linde's March 29, 1944 letter asked for MED's "approval" to use its underground wells, MED carefully avoided expressing a preference in writing for either of the two disposal schemes outlined by Linde. Rather, in its April 3, 1944 reply,

[see Appendix] MED stated that it left "to the discretion of the contractor the selection of the method of disposal most satisfactory to all concerned."<sup>38</sup> However, MED did not wholly ignore the potential consequences arising from the disposal of wastes from its plant and thus requested that Linde assess the likely environmental impact. With regard to the creek disposal method, Linde was asked to provide "an opinion as to the detrimental effects, if any, to persons or vegetation (sic) coming in contact with the diluted liquors in Two Mile Creek."<sup>39</sup> Alternatively, if Linde elected to discharge the effluent into its wells, MED requested that Linde ascertain the following prior to the expenditure of any government funds:

- "a. The well will take the discharge at the required rate over a long period of time.
- b. That contact of the liquors with the well water and surrounding underlying strata will not cause a chemical reaction precipitating solids which might eventually cause plugging of the well.
- c. Introduction of the effluent into the underground stream will not to the best of your knowledge effect the use of the water in other plants or installations for normal purposes. (Our attitude on this is that even though we might not be liable from a legal standpoint, we might from an ethical point of view be doing something which would effect the production of other war plants, and could be severely criticized for our actions). (emphasis supplied)<sup>40</sup>

The reference above to "legal" and "ethical" considerations arising from the disposal of the effluent in underground wells demonstrates MED's collective state of mind at the time. From MED's perspective, the pertinent "ethical" consideration was not whether the community would be injured by its disposal practices, but whether war production at other nearby plants would be impeded.

MED also sought to insure that Linde would not, at some later date, expect the Government to clean up the contaminated wells. "We would like some assurances" wrote Captain Van Horn that:

"the Government will not under the terms of the contract be required at some later date to remove any effluent which may remain in the well or be required to restore the well to its original condition."<sup>41</sup>

Within one day, Linde management responded to MED's request for additional information and "assurances". Its letter [see Appendix] began:

"Replying to your April 3, 1944 letter, we are pleased to receive your approval of the plans submitted covering the disposal of Step 1 material."<sup>42</sup>

The dynamics of the situation were intriguing. Linde was clearly not about to act without explicit MED approval for disposal of the wastes underground. Moreover, Linde's ambiguous responses to MED's requests for further information proved that it would not guarantee the success of the well disposal method, or that this method would not affect other war plants.

Linde admitted that it had not definitively ascertained that the wells would be able to take the Step 1 effluent at the required rate over a long period of time. In fact, Linde conceded that its conclusion that the wells were a workable alternative was based solely on:

"the fact that in testing fire prevention equipment at our Tonawanda Factory, four 600 gallons per minute streams, a total of 2,400 gallons per minute, were discharged into the well without any difficulty. Since we have a total of approximately 150,000 gallons per day to be discharged into the well, we believe that there will be no difficulty in disposing of the material on this basis."<sup>43</sup>

There was "no reason to believe," Linde assured MED, that the Step 1 liquid wastes would chemically react with the well water and underlying strata or that precipitate solids would eventually plug the wells. As discussed herein, the subsequent history of use of the wells would prove otherwise.

Linde was even less specific concerning the critical question of whether pumping the effluent underground would affect the water used in the surrounding region and/or affect the production of other war plants. Linde repeated that it had chosen the well disposal method precisely because, due to the uncertain course of subterranean streams, no one would be able to fix responsibility for the resultant contamination. Linde described its previous personal experience in this regard. Its own well, had been rendered unusable, Linde strongly suspected, after being fouled by:

"someone else in the vicinity, we assumed it to be the Dunlop Tire Company but we have ~~no~~ recourse other than to discontinue use of the wells."<sup>44</sup>

Linde did not pretend to MED that it could accurately predict the effect of the discharge into the underground wells. Its admitted lack of information concerning the impact of well disposal lent itself to few solid assurances:

"If there were any definite means of determining the effect of this discharge into the water basin, we would be glad to do so but it is not thought that any final conclusions could follow a survey of the situation. Certainly we would not take any action which would interfere with the production of other war plants if we could obtain any knowledge that this would be the effect."<sup>45</sup>

The one assurance Linde was able to provide unambiguously was that it would not look to the Government to clean up its wells once plant operations had ceased:

"In view of the difficulty that would be experienced by the Government in attempting to remove any effluent which might remain in the well on the expiration of the contract, it would be unreasonable for our Company to expect the Government to restore the well to its original condition because the water from the well is useless for our purposes and we have no plans for its future use when instituting the practice of discharging the filtrates from Step 1 into it."<sup>46</sup>

As far as Linde was concerned, additional contamination of its already useless wells was an acceptable sacrifice. Linde's neighbors were not asked their opinion.

#### Clogging of the Wells; MED Refusal to Drill New Wells

Sometime subsequent to April 1944, disposal of the Step 1 wastes into the Plant #1 well began. From the start, numerous operational difficulties were encountered, setting in motion a cycle of events that continued for over two years. This history is traced in detail in the following pages in an effort to portray the flavor of the MED-Linde relationship and the prevalent attitudes with regard to waste disposal.

As MED had originally feared, the contact of the liquors with the well water caused a chemical reaction plugging the wells. To unclog the wells, periodic cleaning and removal of the sediment which had formed on the well walls was required. While the wells were being cleaned, the effluent had to be dumped into Two Mile Creek, despite Linde's prior objection that this method violated New York Law and was unsafe.<sup>47</sup>

Disruptions in the use of the Plant #1 wells grew more frequent in August 1944, at which time Linde officials requested permission from Captain Van Horn to drill additional wells on the property which would allow for "continuous disposal" of liquors

during well-cleaning operations, when the existing wells were blocked.<sup>48</sup> Van Horn denied permission to drill new wells, suggesting that since "the amount of effluent to be disposed of will grow less in the succeeding months" every effort, including cleaning, should be made to use the existing wells.<sup>49</sup>

Well-cleaning failed to eliminate the clogging problem. Six days after one well was put back in service, Linde reported to MED that it had overflowed twice during periods of high rate of flow of Step 1 effluent. Because of the brief effectiveness of the cleaning process and since the wells were likely to repeatedly overflow Linde again strongly recommended to MED that additional wells be drilled to handle liquor disposal.<sup>50</sup>

Captain Van Horn responded that MED was reluctant to authorize the drilling of additional wells without knowing whether they would operate more efficiently than the present ones. Apparently conscious of budget limitations and anxious to find a less expensive means of disposal, Van Horn requested that Linde "determine definitely that there is no other more economical and practical method of disposing of the effluent."<sup>51</sup>

#### Repeated Requests For More Wells Denied

In October 1944, Linde responded that it had used its wells for two months without having to clean them, thus demonstrating, Linde said, that the well disposal method could be economical. If additional wells were drilled, Linde suggested, this method of disposal might be usable for an extended period. However, at the same time, Linde ominously reported that the levels of the effluent in the wells were rising steadily, and were expected to "soon" overflow again during high flow periods.<sup>52</sup>



An unusually severe winter in 1945 caused problems of a different kind -- freezing of the effluent pipeline, which caused the wells to be out of service for extended periods. To correct the problem, Linde suggested that the long pipeline be thawed. Linde also seized the opportunity to once again recommend that two additional wells requiring shorter pipelines be drilled on the Ceramics Plant property as a "safety factor against possible future plugging of the present wells...."<sup>53</sup> At MED's request, Linde calculated the time required for drilling new wells, as compared to installing thawing equipment on the existing line.<sup>54</sup> The time required for each alternative was approximately the same, as was the cost. Nevertheless, MED opted not to drill the new wells. MED's Area Engineer, Captain Van Horn, tersely observed in a letter to Linde that the wells had originally been used for disposal at Linde's recommendation, that MED had already invested a "sum of money" in this method, and, therefore, that "it is believed advisable to continue the use of these wells." Although he approved the installation of thawing equipment, Van Horn directed that it be delayed until late summer, since the work could only be completed in warmer weather.<sup>55</sup>

#### Corrosive Vapors From the Wells

Less than one month later, in March 1945, the disposal problem worsened considerably, requiring a modification in disposal methods that could not be put off until summer. On March 16, 1945, a Linde Plant #1 official reported [see Appendix] that the Plant #1 wells had for the past ten days, been discharging "very strong ammonia-laden vapors from the wastewater

rising from the wells and [were] blowing into the Compressor Room."<sup>56</sup> Although the wells were flushed out three times, they continued to discharge vapors which were so strong that the operators in Linde's Compressor Room were unable to stay continuously on duty.<sup>57</sup> If the condition were allowed to continue, it was warned, the vapors would eventually corrode the switchboards and other equipment in the Compressor Room. To eliminate this threat to the plant's physical security, Plant #1 management requested the Ceramics Plant to discontinue emptying your waste water in our deep wells and to make other waste disposal arrangements by April 5, 1945.<sup>58</sup>

#### Continued Problems with Well Cleaning Methods

Despite the request of Linde's own management to terminate the well-disposal operation, the pumping of wastes into the Plant #1 wells continued. Cleaning the wells with an "airlift" made them usable for three to four weeks. However, as originally feared and later confirmed, cleaning the wells was only a superficially effective solution. It appeared to relieve the stoppage problem only because, as part of the cleaning process, effluents would be pumped out of the wells, thereby creating space in the wells for additional liquid.<sup>59</sup>

Linde repeated its advice to MED that continual cleaning of the wells was not a long-term solution since, during well-cleaning periods, the effluent had to be discharged into the nearby storm sewer. Linde deemed this disposal method unsatisfactory because of the clear public hazard (and potential liability) it created. The storm sewer, Linde noted, emptied

directly into an open ditch located in the public park across the street from the plant. The ditch ran approximately 100 yards to Two Mile Creek, which then meandered through the park until it joined the Niagara River. [See Figure 6] Linde's Plant Superintendent did not hesitate to express his disapproval of this disposal method. He objected to MED that discharge to the Creek:

"results in a hazardous condition, since these alkaline liquors run through open waterways where users of the park can easily come into contact with them. It is aggravated by the fact that in the summertime children are often seen wading in these waters in search of lost golf balls."<sup>60</sup> [see Appendix]

It was equally unsatisfactory, Linde observed, to dump the effluent, as had been done "in a few cases of emergency", into a drainage ditch running just north and outside the Ceramics Plant fence. This ditch, like the storm sewer, also ran into Two Mile Creek. However, before entering the Creek, these "hot, alkaline liquors" would run for about a quarter of a mile over unfenced property. "For reasons of public health and safety", Linde cautioned MED, this method could not be used.<sup>61</sup>

The best available alternative, Linde reiterated, was the drilling of additional wells. Although the cause of the existing wells' failure could not "be accurately described", Linde speculated that the "sodium carbonate and sulfate" in the effluent reacted with the "lime in the subterranean waters" to create deposits of limestone and gypsum that clogged the well.<sup>62</sup> Linde admitted that this was likely to occur in the new wells and that new wells would have to be drilled periodically. Linde

assured MED that this was "common practice where wells were used for the disposal of waste waters."<sup>63</sup>

It is apparent that Linde was not the only local firm to use the well disposal method for liquid chemical wastes. A well drilling contractor consulted by Linde advised that the drilling of much deeper (3,100 foot) and more expensive wells would be guaranteed to hit water, and would thus have a larger capacity. The contractor had observed that "a number of people in this vicinity are using this strata for discarding wastes...."<sup>64</sup> The identity of these waste disposers was, unfortunately, not indicated.

A new 150-foot well near the Ceramics Plant was finally dug in early May 1945 and was put into operation by May 14th.<sup>65</sup> In view of the well's limited expected lifespan, Linde recommended that an additional well be drilled for standby use. This advice was accepted, and a new well was drilled and was operative by June 27, 1945.<sup>66</sup>

#### Operation of New Ceramics Plant Wells

The weekly reports prepared by Linde concerning plant operations document that a huge volume of waste liquids were pumped into the new wells. Between May 21 and June 11, 1945, 3,325,000 gallons were disposed of in the first of the new Ceramics Plant wells.<sup>67</sup> By July 19, over 9,400,000 gallons had been pumped into the two wells.<sup>68</sup>

Predictably, the new wells began backing up by mid-August 1945. The Step 1 effluent flow was too great for the capacity of the wells. Although it was possible to divert some of the liquid

wastes to the Plant #1 wells, these wells were essentially blocked and thus could handle only a limited quantity of effluent. To handle the overflow, the drainage ditch was used, and a cold water was pumped to the ditch to cool down and perhaps dilute the effluent.

By diverting the wastes to the ditch, MED's uranium processing operation could continue unabated. Despite its drawbacks, ditch disposal was a necessary measure, agreed Linde engineers, to "avoid slowing Step 1".<sup>69</sup> Linde was clearly uncomfortable, however, with being compelled to use this stop-gap disposal method. Linde foresaw that as the capacity of the existing wells decreased, increasingly large quantities of Step 1 liquors would have to be sent to the drainage ditch, advised MED that "the use of the ditch for the disposal of Step 1 liquors...cannot be continued..." Accordingly, Linde requested permission to drill two additional wells.<sup>70</sup> In addition, Linde asked for approval to purchase a high pressure pump for an existing well that, it was hoped, would induce a phenomenon known as "parting of the planes." By pumping the liquid wastes into the wells at high pressure, Linde experts believed, underground fissures or seams would be opened to allow the passage of additional waste liquids.<sup>71</sup> Such "parting" was already believed to have partially occurred, but the use of high pressure pumps was necessary to achieve additional disposal capacity.<sup>72</sup>

Linde's request to install these pumps was ultimately disapproved by Major Van Horn (apparently promoted to Major in August 1945). The reasons he cited were the costs of the

required equipment in comparison to other methods, the six month delay that would be required to procure the equipment and to install the pumps and the fact that "[n]o assurance has been given that this method will successfully dispose of the effluent."<sup>73</sup>

#### Drainage Ditches in Frequent Use

Despite Linde's strong reservations, disposal of the Step 1 liquors into the drainage ditch continued through the fall of 1945. The two new Ceramics Plant wells, which had received nearly 20,000,000 gallons of liquors in the three months since they had been drilled, were unable to absorb all of the liquors being produced. In fact, Linde reported that a full 40% of the total Step 1 volume was being sent either to the ditch or the Plant #1 wells. Since the Plant #1 wells had long since overflowed, it could be surmised that their capacity for waste was minimal and that most of the liquors were being sent to the ditch.<sup>74</sup> This was confirmed by a report that the two Ceramics Wells had "failed completely to take [the] effluent liquors", and that the "temporary" line to the drainage ditch which had been installed was being used daily.<sup>75</sup>

#### Objection by Linde to Ditch Disposal

Although it hardly seemed possible, the problem with the disposal of Step I liquid wastes from the Ceramics Plant soon worsened. In October 1945, an intra-office memorandum between Linde management executives indicated that one of the Ceramics wells had backed up to the surface of the plant area and had to be temporarily abandoned. The one well still in service was

partially plugged and 80% of the Step 1 effluent had to be diverted into the open ditch. Linde officials placed the blame for the existing situation squarely on MED. They noted that:

"The Army has resisted our plans to dig more wells or spend additional money for pressure parting to make the well method of disposal more efficient."<sup>76</sup>

Dumping the Step 1 liquors into Two Mile Creek remained totally unacceptable to Linde management, because of the hazards and potential legal liabilities involved, liabilities which the Army steadfastly refused to assume. A Linde official wrote:

"We are unwilling to divert this hot lye water effluent to Two Mile Creek because of the liabilities involved, although the Army has requested that we do so in spite of their unwillingness to write us a letter ordering us to put the effluent in the creek and absolving us from any legal action, criminal or civil, which might result."<sup>77</sup> [see Appendix]

Linde's advice to MED was that the effluent could be diverted to the creek so that it was "non-injurious to humans" only if it were properly neutralized with sulfuric acid. However, this method was costly. To completely neutralize the pH 11 liquors to a pH of 7 would require, on a daily basis, 14½ tons of sulfuric acid, at a cost of \$246 per day. Lowering the pH to 9 cost \$195 per day. The additional equipment that was required would cost \$4,000.<sup>78</sup>

It was cheaper to dump the effluent into additional underground wells, Linde noted, since each new well cost only \$7,000 to drill. Linde again recommended that yet additional wells be drilled to avoid having to dispose of 80% of the liquors into the ditch. The dangers of ditch disposal were readily apparent, Linde observed, since:

"The ditch is unprotected by any fence and would undoubtedly injure anyone who fell into it. Down stream from the point where this ditch enters Two Mile Creek, the creek flows through a public park and golf course."<sup>79</sup> [see Appendix]

There is no evidence that either MED or Linde, although aware of these dangers, guarded or placed any warning signs or barriers near the creek. None of the records reviewed indicate whether any injuries were in fact caused by the dumping of Step 1 waste into Two Mile Creek.

Despite Linde's hesitance, the Ceramics Plant continued to dump the effluent into the creek. A well expert consulted by Linde reviewed the various available alternatives and also recommended the drilling of additional wells. Cost estimates for the various proposals were requested by MED but no final decision was promptly made. Linde management was growing increasingly uneasy, as evidenced by an excerpt from the following intra-office communication, which stated:

"Please follow the Army closely for a reply to this proposal and advise us at once of their decision in the matter as we are unwilling to permit the effluent to flow to the creek any longer than is absolutely necessary."<sup>80</sup>

#### MED Refusal to Approve and Pay for Alternative Disposal Methods

Finally, in a January 25, 1946 letter, Major Van Horn disapproved the installation of high pressure wells. He did not, however, authorize the drilling of new wells. The high estimated cost of the pumps, wrote Van Horn, "justifies a more thorough analysis of all other possibilities."<sup>81</sup> In the meantime, Linde was requested to measure the pH and temperature of the Step 1 effluent at various points along Two Mile Creek.<sup>82</sup> These



measurements, when completed, showed that "the highly alkaline condition" carried for a considerable distance through the public golf course.<sup>83</sup> Linde again warned that it was "highly undesirable" to continue using the open ditch for the disposal of these wastes.<sup>84</sup> Incredibly, despite Linde's warnings of danger and scientific analysis, MED recklessly continued to dispose of its hazardous liquid wastes into Two Mile Creek.

#### Corrosion From Step 1 Liquors

When caustic liquors were discovered "seeping through the ground and deteriorating underground conduits and pull-boxes at Plant #1, particularly in the service tunnel connecting the building,"<sup>85</sup> it became clear that a more permanent disposal solution was required. The leakage of effluent had resulted in the "accumulation of crystalline salts on the tunnel floor."<sup>86</sup> It was believed that the building's structural integrity was potentially threatened:

"These liquors are also entering the tunnel through cracks in the wall and it may be attacking the concrete of the tunnel and building foundations themselves."<sup>87</sup>

Further analysis by Linde evidenced severe corrosion of conduits and conduit boxes whenever they came into contact with the surface water at the plant contaminated by the Step 1 effluent. A Linde official summarized the desperate situation as follows:

"Numerous conduit boxes are already in bad condition but the most serious feature appears to be the fact that, since the soil is already contaminated, the condition will persist for an indefinite period, even with the present concentration and continued contamination which will make the condition progressively worse.

The analysis given in the attached letter indicated beyond doubt that the material in the surface water is caused by presence of effluent from Ceramics Plant processes which are being pumped into shallow wells on the Ceramics Plant property. It appears that there is some fault in the cap rock which permits the solution being pumped to levels below the cap rock to come to the surface at one or more points in the factory property. If this condition is permitted to continue, it will undoubtedly result in complete deterioration of the conduit, cable and piping which would make necessary complete excavation and replacement of existing lines at a cost of several hundred thousand dollars. We, therefore, feel that steps must be taken immediately to alleviate this condition, even though it involves major changes in the procedure being followed for the disposal of fluid wastes from the Ceramics Plant."<sup>88</sup>

None of the documents received by the Task Force reflect whether any changes in plant procedure were made following the revelation of these conditions. Subsequent documents indicated that the damage was less severe than first thought.<sup>89</sup> On June 1, 1946, MED finally authorized the drilling of two low pressure wells, at a cost of \$560 per well.<sup>90</sup> Linde was directed that:

"Immediate action should be taken by your office to complete this work so that dumping effluent into the creek can be discontinued at the earliest possible date."<sup>91</sup>

The two new wells went into service on June 4 and June 6, 1946. They were used only for a short period, since the Linde Step 1 process was shut down in mid-July 1946. While operative, they received an estimated 1,500,000 gallons of effluent. Not surprisingly, even these wells soon began to back up, and Linde advised that if the plant continued operations, additional wells would be required.<sup>92</sup>

The following chart reflects data prepared by Linde<sup>93</sup> summarizing the use of the wells for the disposal of Step 1 wastes:

<u>WELL</u>	<u>PERIOD IN SERVICE</u>	<u>TOTAL VOLUME PUMPED TO WELLS</u>	<u>COST</u>
Plant #1	2/27/45 to 6/27/45	16,500,000	
Ceramics #1	5/16/45 to 1/01/46	13,000,000	\$535.
Ceramics #2	6/27/45 to 10/8/45	6,000,000	560.
Ceramics 3&4	6/06/46 to 7/15/46	1,500,000	628.
	6/06/46 to 7/15/46		628.

### C. EPILOGUE

As the result of an inexplicable lapse in bureaucratic memory, the Linde wells have apparently lain undisturbed and unmonitored for over thirty-four years.<sup>94</sup> None of the MED documents obtained from DOE indicate that any remedial work or follow-up analysis has been performed at the site. DOE's FUSRAP Report, which discussed radioactive contamination at LOOW, the former Haist property, and at the Linde plant site, ignored the existence of the wells entirely. Thus, the impact of the disposal of 37 million gallons of radioactively contaminated wastes into underground wells remains undetermined to this day.

As a general matter, the advisability of the disposal of chemical wastes in underground wells is questionable. In a recent series of articles on toxic waste appearing in the Louisville Courier-Journal, the current controversy surrounding this method of disposal in Kentucky and elsewhere was explored.<sup>95</sup> The underground disposal wells currently in use (and the subject of considerable debate), are one-half to 2 miles in depth. In contrast, the Linde Wells, which were only 130-150 feet deep, were quite shallow. duPont's Louisville plant presently uses a 3,100 foot well to dispose of waste hydrochloric acid. The acid, as it is neutralized by the limestone rock at the base of the

well, is reportedly eating out a huge cavity underground. No groundwater contamination has been traced to the duPont well. Nevertheless, the lack of knowledge concerning the geologic effects of this well disposal has made it the subject of considerable criticism. It is feared that the effects of deep well disposal might not appear for many years and could be irreversible.<sup>96</sup>

On the other hand, some scientists believe that if chemical wastes are injected into wells located in geologically secure locations, the underground disposal method can be effective and efficient.<sup>97</sup> The Linde wells, it should be noted, were selected not because of the suitable geology of the site, but simply because they were there. The critics of the well disposal method say that the wells are "little better than sweeping industrial garbage under the rug" and have "already caused minor earthquakes and significant water pollution."<sup>98</sup> One of the examples cited by critics was the injection of toxic waste more than two miles beneath the surface by the United States Army at its Rocky Mountain Arsenal. When earth tremors, which had been rare in the Denver area, began to occur, the injection of the waste was suspected, but it took five years for sufficient evidence to be collected to convince Army and environmental officials that injection was "probably causing the disturbances."<sup>99</sup>

In 1968, the top of a deep well located near Lake Erie and used by Hammermill Paper Co. blew off. Before it could be capped, the well poured over 4 million gallons of chemical waste into the lake. Also cited in the Courier-Journal article was a

congressional subcommittee finding that 32 separate cases of ground water pollution have been caused by the injection of waste underground.<sup>100</sup>

The most frequent criticism of well disposal is that the waste, once injected, cannot readily be controlled or monitored. As an Indiana Health Department official observed:

"There is no way of knowing where the hazardous wastes are really going. If you discover a problem, what can you do with it? In most cases, just about nothing."<sup>101</sup>

The environmental effect of the disposal of millions of gallons of radioactively contaminated chemical wastes into the Linde wells, is a mystery. The site might require remedial work or could very well be unremediable. At the very least, it is advisable to closely study the surrounding region in order to determine whether there has been any significant impact on ground or well water. One thing is clear--the existence of the Linde wells can no longer be ignored.

## FINDING IV

CIVILIAN WORKERS AT VARIOUS MANHATTAN PROJECT AND ATOMIC ENERGY COMMISSION PLANTS IN THE NIAGARA FRONTIER REGION WERE, DUE TO PRIMITIVE FEDERAL STANDARDS AND INADEQUATE PROTECTION, EXPOSED TO EXCESSIVE LEVELS OF RADIATION.

### Introduction

Over the years of the Manhattan Project and early Atomic Energy Commission operations, many New York workers were exposed to excessive levels of radiation. In many cases, the workers were not made fully aware of the hazards involved with radioactive substances, partially due to the secrecy of the projects, partially because research on radiation effects had not sufficiently considered long-term effects on human beings. In the 1940s especially, radiation effects were judged largely on the basis of immediate toxicity, not on the basis of latent, long-term effects. Exposure of workers to large, sudden doses was avoided, not always successfully, but little consideration was given to extended exposure to low-level radiation.

Government-financed and independent studies conducted since World War Two have called increased attention to the latent effects of exposure to low-level radiation, particularly in the workplace. Leukemia and cancer incidence as a result of exposure to radiation is now an accepted premise of every licensed health physics program.

Even though studies have resulted in better worker protection, little is known about the health histories of workers who were exposed during World War II and after in Western New York. The men and women who worked at Linde Air Products and

Electrometallurgical Co., and later at Lake Ontario Ordnance Works, Simonds Saw and Steel, Bethlehem Steel and other locations may have been the unwitting casualties of Hiroshima, Nagasaki, Bikini atoll, and the Cold War arms race.

Whatever their sacrifice may have been, it has gone unacknowledged by Federal authorities. There is no evidence that officials have ever looked into the health histories of these workers. Records made available to Task Force Investigators indicate that many workers were exposed to radiation which exceeded even the primitive standards of the time. At one point, the permissible exposure limits were even raised in order to spur the war effort.

The discussion that follows will focus first on the exposure standards and safety procedures used by Manhattan Engineer District and AEC. Documented indications of worker over-exposure will then be set forth, followed by a discussion of recent studies which have given new meaning to radiation effects.

A. Methodology of Development of Exposure Standards

In April of 1943, the head of the Manhattan Project, Major General Leslie R. Groves, appointed Dr. Stafford L. Warren chief of the Medical Section of the project. Dr. Warren, who since 1925 had been chief of the Department of Radiology of the University of Rochester School of Medicine and Dentistry, was assigned the job of setting up the medical program for the Manhattan Engineer District and organizing a research group in Rochester to investigate new areas concerning the effects of human exposure to radiation, especially in the development and production facilities involved in refining uranium and making the atomic bomb.<sup>1</sup>

Headquartered first in Rochester, then moved to Oak Ridge, the Medical Section performed the following tasks:

1) to analyze data from pre-employment physical examinations of persons employed at the Manhattan Project's industrial plants all over the country;

2) to advise the plants on how to protect workers from radiation exposure by

a) determining "tolerance standards" for doses of radiation,

b) developing instruments to measure workers' exposures to radiation,

c) determining by measurement which areas of the plants showed the greatest intensity of radiation,



- d) determining the amount of contamination in workers' clothing, and
- e) advising on precautions to be taken to safeguard workers from exposure.

Other tasks included determining how much uranium dust had been inhaled or swallowed by the workers, or absorbed by their bodies, and to investigate the effects of radiation when received directly.<sup>2</sup>

The Rochester laboratories received breath and urine samples as well as film badges from workers in plants all over the country, and records were maintained by the staff. As information was gathered from the field, experiments were undertaken on laboratory animals to determine the biological effects of exposure to radiation. The experiments were used to determine the amount of radiation exposure which could be safely tolerated by humans. In the absence of data from actual human exposure, the scientists in Rochester used 200 monkeys, 675 dogs, 20,000 rats, 277,400 mice, 100 hamsters and 1,200 rabbits to determine safe levels of radiation exposure to workers in Linde Air Products, Electrometallurgical Co., and other New York contractors for the Manhattan Project.<sup>3</sup>

The occupational safety standards for the Manhattan Project were based almost entirely it seems, on data from exposures of laboratory animals, not humans.<sup>4</sup> The standards which resulted from this experimental work have been under attack of late as a

result of studies analyzing data from actual human exposures to radiation in AEC-operated facilities. By measuring ambient radiation in MED plants, such as Linde and Electromet, analysts in Rochester were able to figure the rate at which uranium dust and other contaminants would be ingested by workers. Workers' film badges, urine samples and breath samples would be used to correlate expected exposures (based on the ambient data) with the actual exposures (based on the badges and samples). Conclusions were then developed and safety procedures promulgated to reduce worker exposures where they exceeded the guidelines.

One exception to the lack of human data on radiation exposure involved radon gas. Dr. Robley Evans, of Massachusetts Institute of Technology, had analyzed data on human exposure to radon gas and concluded that "concentrations of the order of 1,000 microcuries of radon per liter of inhaled air leads to a 30-fold increase in the incidence of lung cancer."<sup>5</sup> He suggested that tolerance levels for radon gas be set at 10 microcuries per liter, a figure embodied at that time in the Massachusetts state code for radium workers. The New York State code set a maximum concentration of 100 microcuries per liter, or ten times the level sought by Evans. His concern was heightened by the introduction in 1943 of African ore as a source of uranium for the Manhattan Project, ore which produced substantially higher radon gas levels than the domestic ore which had been processed up to that point.<sup>6</sup> The higher uranium content of the African ore led scientists and engineers to adjust workplace procedures so as to minimize worker exposures.

An example of how exposure standards were used in the Manhattan Project is contained in a "Report on Radioactivity Tests," by G. Failla, (October 1, 1943). In his report Dr. Failla reports on his analysis of beta ray activity on several samples of process material extracted from nearly 20 stages in the Linde refining process. The procedure was employed to analyze the degree of possible worker exposure to radiation based on the activity of the samples at each stage of production. His analysis formed the basis for recommending .55 roentgens per week exposure to the worker's body, an amount which compares to the present allowable occupational dose of 5 rems for a year. (A rem is equal to 1.13 roentgen) He also analyzed the effect to the worker of wearing gloves to protect the hands from the radiation.

"In a previous memorandum I have suggested that for the purpose of protecting personnel engaged in this work, 5.5 r/week (roentgens per week) is a safe dosage rate for local exposure of the skin on the hands. On this basis a worker could have his hands in contact with Mx (uranium for  $5.5/0.25 = 22$  hours in one week. If the worker wears gloves of any reasonable thickness the number of hours per week may readily be doubled. (Gloves should be worn in any case because of the possibility of absorption of radioactive material through the intact skin or skin with cuts or scratches. There is very little known about this at present and it is best to be on the safe side.) Wearing suitable gloves, therefore, a man can handle Mx during the entire time of a 40 hr. working week, insofar as the radiation effect on the skin of the hands is concerned. It should be ascertained, however, that the whole body gamma ray dose received by the worker in the performance of his duties does not exceed 0.55 roentgens per week."

This example of the application of research data to practical workplace situations characterizes the methodology used by the Manhattan Project to protect its workforce. Whether or not the weekly dosage of .5 roentgens was safe, it is

questionable how the scientist reached the conclusion that the exposure time could be "doubled" with the use of gloves "of any reasonable thickness". There is no indication that the projection was based on any analysis other than guesswork.

Moreover, there is no indication that the workers themselves participated in any of the decisions which resulted in their "protection." "Mx" was only one of several codes for the substance uranium. The code system was part of the project's security program. Even technicians who worked on the project at Rochester were not necessarily aware of the work of persons in adjacent laboratories or offices.<sup>8</sup> Clearly the secrecy and internal security of the Manhattan Project meant that workers who were exposed to radiation were unaware of what was happening to them. Without the knowledge of the materials they were working with, the workers were unable to advocate on their own behalf for safer, cleaner working conditions. The amount of danger which workers confronted in the workplace was decided by scientists and engineers based on experiments with laboratory animals, for the most part. In establishing "acceptable" levels of risk for the workers, the scientists and engineers had to balance worker safety with other factors such as the need to maintain production levels (especially in ore refining and metal conversion plants) and still keep costs within budget limitations. At times, the needs of the war effort forced worker safety into a lower priority than might have been the case in peacetime.

## Uranium Dust Toxicity Compared to Lead Dust

In a compilation of abstracts of research at the University of Rochester, Joe W. Howland, a major in the Medical Corps and chief of the Research Branch of the Manhattan Project's Medical Division, characterized the early knowledge of project scientists about the substances they worked with and their sense of priorities concerning the war effort.

"This potential toxicity (of uranium compounds) is rather unusual because the source is twofold. One source is the possibility of heavy metal effect on the body, comparable with that of lead, mercury, and arsenic; and the other, more remote, is the possible latent toxic effect on body tissue by the uranium compounds because of their inherent property of radioactivity.

"The medical authorities of the Manhattan Project were keenly aware of these potential hazards, but the successful execution of the war effort made it imperative that the industrial plants of the Manhattan Project start immediate operation. This was accomplished in spite of insufficient pharmacological and toxicological data on the uranium compounds."

Howland reported on the establishment of the medical program to accumulate reliable data quickly so the safety of employees could soon be assured. But, he added,

"since the plants started operation before sufficient data could be accumulated to establish a maximum allowable air concentration of the dusts of the uranium compounds in the plants, such a safe level had to be set arbitrarily as a temporary empiracle standard. The concensus of opinion among the medical authorities of the Manhattan Project was that it was safe to adopt the same standard as set for lead by the American Standards Association, i.e., 150 micrograms per cubic meter of plant air, <sup>9</sup>as the maximum allowable dust concentration."

## Allowable Concentrations Raised to Spur War Effort

As with so many other issues which have been discussed in this Report, the urgency of the war effort required that

environmental and safety precautions give way to production and cost considerations. By early 1945, the needs of the war effort began to prevail decisively over the requirements of worker safety, and maximum allowable concentrations of uranium dust were more than tripled for the Manhattan Project's industrial workplaces.

The process by which this decision was reached is perhaps indicative of how the war affected scientific research, and to what ends that research was turned. In today's regulatory world, the principal of worker protection is based on the notion that exposure to radiation should be "As Low As Reasonably Achievable," or ALARA. During the war, however, production took precedence over worker safety, and the medical team set standards as high as could be justified. In a letter to Lt. Col. H. L. Friedell April 26, 1945, Drs. Carl Voegtlin and Harold C. Hodge indicated that they had virtual instructions to justify the highest concentrations of uranium dust in workplaces.

"It is our understanding that the maximum allowable concentration should be set as high as we can justify," they said.<sup>10</sup>

Voegtlin and Hodge acknowledge that the reason for recommending that the concentration be raised from 150 micrograms to 500 micrograms was to spur war production.

"One of the reasons why we recommended 500 micrograms per cubic meter as the maximum allowable concentration is that we view this as an emergency war measure to expedite industrial production."<sup>11</sup>

To back up their recommendation with quantitative data, Voegtlin and Hodge produced the results of experiments in which

various small animals--guinea pigs, rats, mice and rabbits--were exposed to concentrations of dust of 20 milligrams per cubic meter, a level many times greater than the 500 microgram per cubic meter level they were recommending. The result of the exposures was an aggregate mortality rate of about six per cent, a figure to which the scientists found it "almost impossible to attach a meaningful degree of significance."<sup>12</sup> The animals were all exposed to dust concentrations of 20 milligrams per cubic meter, and as a result, four of seventy guinea pigs died, three of sixty-four rats died, and seven of 112 mice died. In spite of the relatively high percentage of deaths among the animals, Voetglin and Hodge were still not "sure that the deaths recorded were due to T poisoning."<sup>13</sup>

In the same series of experiments, 32 rabbits were exposed to the same concentrations resulting in seven deaths. Not all of the rabbits were exposed to the same compounds of uranium, however. Twenty-two of them exposed to  $U_3O_8$ ,  $UF_4$  and uranium ore incurred a five per cent mortality rate (one death), while, among ten others exposed to  $UO_2$ , six died. Voetglin and Hodge expressed the same uncertainty that among the 22 exposed to the first three compounds, uranium might not have caused the deaths:<sup>14</sup> "this 5% mortality is subject to the same degree of uncertainty" as the six per cent rate from the tests on guinea pigs, rats and mice. They did observe, however, that  $UO_2$  could not be treated the same way, stating that:

"it appears to have a special lung toxicity for rabbits. The histopathological observations confirm this assumption; considerable lung damage was observed in these rabbits. The mortality data from the inhalation experiments pose a question as to the 'practically innocuous' nature of these four compounds, however, these data can not be taken as clear cut evidence of<sup>15</sup> a marked degree of toxicity upon inhalation."

Later in the same report, Voegtlin and Hodge openly admit that their recommendation for higher allowable concentrations is based on insufficient data and, even, heresay.

"Obviously more data are needed on the inhalation toxicity of these four compounds; especially are data needed on animals exposed to dust concentrations nearer that of the maximum allowable concentrations -- 0.5 mg./m<sup>3</sup>. We expect to conduct such studies within a year, but our attention has been directed so far to the compounds with higher priorities.

No Human Acute T Poisoning. - Heresay may have no place in a scientific discussion, but we have based our recommendations of a maximum allowable concentration in no small part upon the word of mouth reports that under the conditions of industrial practice no cases of human T poisoning have been discovered."<sup>16</sup>

This report by Voegtlin and Hodge, was based on superficial data which could have been conservatively interpreted as indicating greater caution with uranium dust. The interpretation that the mortality rates among laboratory animals was either not significant or subject to uncertainty is certainly a case of stretching information to fit a predetermined conclusion. The only logic by which Voegtlin's and Hodge's experiments can be used to justify higher dust concentrations is if one accepts their contention that the five to six per cent mortality rate is not attributable to the dust exposure. If five to six per cent mortality is considered "natural," (that the deaths would have



occurred even without the exposures), then the dust could not have caused any deaths at all. Extending such logic, it might be asked whether dust concentrations of 20 milligrams per cubic meter would therefore be considered safe for humans. Similarly, if five or six per cent mortality is considered "natural," what mortality rate would have led the scientists to find a causal relationship between the dust and the deaths? Ten per cent, fifteen per cent? Such a standard is nowhere to be found in the report of the experiments. The absence of a discussion of this issue calls into question the method of the scientists conducting the study. The use of hearsay information to increase the danger to workers stands as ample testimony to the effect which the war had on scientific and industrial practices.

The Voetglin and Hodge report was submitted to the chief of the project's medical section, Col. Stafford L. Warren. His directive to the Madison Square Engineer raising the concentration limits, treated the report as if it had real scientific validity.<sup>17</sup> He referred to it as "a special report." He said the recommendation was based on the results of the animal exposures, but he treated  $\text{UO}_2$  (the compound which may have caused the deaths of six of ten rabbits) in the same way as the other dust compounds which showed only five or six per cent mortality. Voetglin's and Hodge's contribution of hearsay information was characterized by Warren as "careful observation of a large group of persons." Warren does acknowledge, however, that another impetus for raising the allowable dust concentrations in the

factories was the difficulty of adhering to the 150 microgram standard.

Referring to the Voetglin and Hodge report, Col. Warren stated that:

"1. This report recommends that the maximum allowable concentration for chronic exposure to high-grade ore,  $T_3O_8$ ,  $TO_2$ , and  $TF_4$  be raised from 150 micrograms per cubic meter to 500<sup>4</sup> micrograms per cubic meter.

"2. This recommendation is based on the results of exposure of animals to these substances, and careful observation of a large group of persons working in industry with these materials during the past two years.

"3. Therefore, in the opinion of this office, the maximum allowable concentration for exposure to high-grade ore,  $T_3O_8$ ,  $TO_2$ , and  $TF_4$ , should be increased to 500 micrograms per cubic meter. In view of the extreme difficulty in maintaining concentrations of 150 micrograms per cubic meter in industry, it is felt that such a change will be of definite benefit in expediting the war effort.

"4. It is recommended that this change in the maximum allowable concentration be transmitted to the contractors under your supervision."<sup>10</sup> [See Appendix]

### Summary

To summarize briefly, the Manhattan District's methodology of worker protection during the war was based on a correlation between 1) ambient radiation or dust levels in the workplace; 2) analysis of worker exposure by breath, urine and other samples; and 3) the anticipated time a worker would spend receiving exposure while performing a specific task. Meanwhile, animal experiments were used to determine "safe" levels of exposure for human beings. At the same time, however, there was a clear realization that safety could be had only at the expense of production, and the needs of the war effort superceded the obligations of the project to protect its workers.

## B. Safety First...or Second

Following are some examples of safety precautions which were undertaken as a result of the analyses of the medical program, then indications in records obtained by the Task Force of probable worker overexposures.

The Manhattan Project's safety program was undertaken with the diligence and thoroughness of other sections of the project. On a fairly routine basis, Army engineers assigned to the Tonawanda Area Office of the Manhattan Project met with management officials of the project's contractors--Linde Air Products, Electrometallurgical Co., and Hooker Electrochemical Co.--to discuss safety procedures in their respective plants.

The safety procedures employed in each facility varied according to the nature and radioactivity of the process material being handled at each stage. Safety and worker health problems received greater attention where the material was more highly radioactive, where dust conditions were greater, or where the radioactive daughter products were known to be a greater hazard. At Linde, relatively low-grade African uranium ore was refined into what was known as black oxide ( $U_3O_8$ ) or sodium diuranate.<sup>19</sup> Higher grade ore was processed at other refineries operated by the project's contractors: Vitro Manufacturing Co., Canonsburg, Pa., and the Eldorado Mining Co. plant in Port Hope, Ontario, Canada. Linde also processed the black oxide into  $UF_4$ , known as "green salt," and that material was converted to uranium metal  $UF_6$  at Electromet in Niagara Falls. Hooker, meanwhile, had a small contract to manufacture a fluorinated lubricant known as P-45.

Each of these processes entailed various hazards in the handling of materials and in the cleanliness of the workplaces. As materials in use changed, so did handling practices. A good example of this occurred in 1943, when the Manhattan Project was first supplied with African ore. Up to that point, Linde had processed domestic ore following vanadium extraction in Colorado.<sup>20</sup>

The African ore, which had a much greater radium content than the domestic material, prompted MED officials to add plant precautions which were designed to protect workers from the greater hazard. A letter from Capt. E. L. Van Horn, the Tonawanda Area Engineer, to Linde management, illustrates some protective steps taken with the introduction of African ore to the Linde facility.

Van Horn's duties were to supervise production at all area facilities contracting with the Manhattan Project. Although he seems to have had frequent differences with management officials at the various companies involved, his authority over production processes was firm indeed. (see section on "The Linde Wells" supra). Excerpts of the directive follow. The parenthetical comments represent penciled-in statements by an apparently skeptical Linde official, possibly T. J. Coleman, to whom the cover letter was addressed.

"e. Determinations of the actual gamma radiation received each by the persons doing the unloading will be made by pencil ionization chambers to determine whether or not rotation of men on the job is necessary. (Will undoubtedly scare the men and start a lot of false rumors. Can be done though).....

"3.g. Supplied air respirators might be required. A decision as to their use will be made in the first two weeks of operations, depending on the results of the tests. (Working under such conditions will require special inducements not covered by a loaders pay.)....

"4. Sampling:....

"c. Work men in the room will be required to wear toxic dust respirators with: (at all times?)

- (1) Fresh filters provided daily or more often, if necessary.
- (2) Clean work clothes daily
- (3) Canvas gloves provided daily

"d. Determinations of the Mz content of the air in the sampling room will be made. If sufficient concentration is present, air supplied respirators will be worn.

(will make sample room a damn unpopular job.)..."

"9. Digest and Pachuca Tanks:...

"b. Employees should not work routinely at a distance of less than 5 feet from the tank. (Have them stand single file in the middle of the deck? Seriously will probably require some remote controls.)...

"d. Personal Hygiene and Cleanliness:...

(3) Washing before meals and taking of showers will be supervised. (Hire a back scrubber?)

(4) Washing of hands will be done with soap and water and a brush. Care will be taken to remove the material desposited under the nails. (Buy individual brushes?)

(5) It is recommended that the use of vanishing creams and active wetting agents be prohibited in the clean-up process until further study can be made. (You tell 'em bub! Not me.)....

(9) If the employee uses chewing tobacco, adequate precautions should be taken to prevent the tobacco from becoming contaminated in the package, and to prevent transfer of X material from soiled hands to his mouth. The same precautions also apply<sup>21</sup> to the use of chewing gum. (How my good fellow?)"<sup>21</sup> [See Appendix]

Various forces, it seems, combined during Manhattan Project days to inhibit and constrain efforts to make workplaces safer and cleaner. The project's medical staff worked hard at

developing exposure standards, but their efforts were countered by others in the Army whose priority was greater production of source and feed materials. For them, safety and health measures represented constraints on production. To the extent that production took precedence over safety, the medical staff was prevailed upon to change its safety standards, as shown by Colonel Warren's letter of June 4, 1945. Even in cases when the scientists and engineers with the project were able to develop a set of operating instructions for the companies running the plants, their efforts were resisted by the companies, as indicated by Coleman's comments. In this context, of conflicting forces within the Manhattan Project, and resistance from the companies, workers were given very little information about the hazards of their work, and in fact were not even told the names of the substances with which they were working. One result of this combination of forces was that workers--uninformed by management, and only sometimes protected by a production-conscious military--were routinely exposed to radiation or dust hazards in excess of even the flexible standards of the day.

### C. Indications of Worker Overexposures

Both wartime and postwar worker safety records have been obtained by the Task Force from the files of the U.S. Department of Energy at Oak Ridge, Tennessee. While it is impossible to concisely characterize all of this large volume of data, it is fair to conclude that the documents are replete with instances either where individual workers received doses of radiation which

exceeded "tolerance levels," or where air dust was above "maximum allowable concentration" levels. Whether such exposures resulted in health problems for those concerned can only be a matter of conjecture at this point. But no studies have ever been done to examine the health histories of the particular workers effected so far as the Task Force could determine. The purpose in publishing this information is to call attention to the workers who may have suffered the ill effects of radiation exposure due to a combination of ignorance, sloppy procedures, corner-cutting and the wartime emergency. After 1946, the Cold War arms race caused the expansion of many of the programs initiated under the Manhattan Project. Technicians and scientists who worked on the Manhattan Project transferred to the new Atomic Energy Commission, and continued the basic policies and programs which created the original atomic bombs. In light of that history, the following examples of worker overexposures are presented from the World War II era through the early 1950s to underscore that the policy of expediency continued unchanged from the days of the Manhattan Project through the beginning of the AEC era.

--In a report on 14 employees' breath samples on August 17, 1944, three samples exceeded "tolerance" levels for radon gas by up to two times. The samples were taken from employees at the Linde Ceramics Plant.<sup>22</sup>

--A report by Capt. John L. Ferry, Medical Corps, to Col. Stafford L. Warren, May 31, 1944, disclosed two chemists at Electrometallurgical Co. had developed symptoms of a possibly radiation-induced illness from their work in the company lab. One chemist had reported fever and anemia, had some infected

teeth and his tonsils removed, but was being treated at the time for a prostatic abscess. Pus was reportedly in his urine, his red blood count and hemoglobin were maintained by liver therapy and analysis was planned to check for uranium and flourine in his urine. The other chemist, doing the same work as the first, complained of burning eyes, headache and general malaise. His blood pressure had risen from 120/70 to 168/90. His throat was inflamed and his pulse was between 120 and 140. His urine contained 0.5% albumin granular and hyaline casts and "5-6 RBC and 5-6 WBC per high power field." In the same report, a number of women employees "who show albumin and white blood cells chronically because of cystitis, cystocele or gynecological conditions have been recommended for transfer to other work".<sup>23</sup>

--A March 1, 1944 visit by Capt. Ferry to Hooker Electrochemical Co. resulted in a report that two workman became ill for two to three days after working on a roof near a stack discharging one kilogram per hour of F2.<sup>24</sup>

--A report from Capt. Ferry's visit November 8, 1943 to the Manhattan Project's facility at Columbia University revealed that a person exposed to "PG" (phosgene gas, possibly) for "about 2 hours from a leaking cylinder" complained of abdominal discomfort, nausea, and vomiting. "A check of his blood count revealed that in the past few months his hemoglobin has fallen from 91% to 69% with a corresponding but less marked drop in the erythrocytes."<sup>25</sup> Evidently, not all the Manhattan Project's workplace hazards concerned radiation.



--A report of occupational exposures at Simonds Saw & Steel Co., Lockport, from October 27, 1948 through August 21, 1951 showed that employees received up to 190 times the preferred level of exposure to dust. Simonds at that time was processing uranium billets into rods, and dust problems at the plant created a considerable problem for the Atomic Energy Commission medical analysts.<sup>26</sup>

--A report of April 5, 1949 in which the results of dust samples at Simonds showed that 32 employees were exposed to up to 10 times the "preferred level" of alpha radiation. "Fourteen (44%) are exposed to 5.7 - 8.4 times the preferred alpha level and fourteen employees (44%) are exposed to 2.1 - 3.7 times this level. The remaining four employees (12%) inhale alpha emitting dust of 1.3 times the preferred level." The same report noted that these levels represented reductions in exposure from up to 37 times the preferred level in a previous survey.<sup>27</sup>

--A report of June 29, 1948 concerning dust hazards at the Linde Ceramics Plant in which:

"the exposure of all employees is shown to vary between 3.0 and 5.8 times the preferred level. Employees have been instructed to wear respirators at most of the dust operations, but their actual use is irregular and is not believed to provide adequate protection. There is a need for additional dust control by means of improved process ventilation, and specific recommendations from us will be forthcoming."<sup>28</sup>

--A report from February 15, 1949 at Simonds Saw & Steel, which showed the effect of the installation of dust control measures. For eight employees, exposure was reduced from 155 to 14 times the preferred level of 50 micrograms of uranium per cubic meter of air.<sup>29</sup>

--A report on radiation, radon and dust during the storage operations of K-65 in the water tower at Lake Ontario Ordnance Works showed workers receiving minimum average exposures of 435 mreps beta-gamma/week. The report, dated November 27, 1950, recommended several steps to reduce worker exposures to 300 mreps/week, including more shielding for the worker removing lids from the K-65 drums, a better dumping mechanism on top of the tower, better storage for damaged drums, use of a crane or magnet for loading and unloading the truck, and the hiring of additional laborers.<sup>30</sup>

--A report of worker exposures at Simonds Saw & Steel dated February 5, 1953 in which dust exposure measurements in specific work locations vary from .46 times the maximum allowable concentration for the Heater Operator to 10 times the maximum allowable concentration for the Pressure Quencher operator.<sup>31</sup>

#### Contemporary Standards, Increased Caution

As these reports and many others in the Task Force's files indicate, some workers were routinely exposed to excessive levels of radioactivity or dust beginning in World War Two and continuing through at least 1953. Other workers were exposed to levels which by today's standards would be considered excessive.

Since the pioneer days of atomic energy, technological progress in the industry has provided not only greater explosive power for weaponry, but has provided health physicists with more accurate knowledge of the effects of dust and radiation on workers. As a result, allowable air dust concentrations, and radiation exposures have been reduced. The maximum allowable

concentration of 500 micrograms per cubic meter, adopted during the war, is now reduced to 200 micrograms for workplaces and 10 micrograms for any place accessible to the public. Table 1 shows how permissible radiation exposures have changed over the years.

Table 1  
Changes in Levels of Permissible Exposure  
to Ionizing Radiation<sup>31</sup>

FOR RADIATION WORKERS

Recommended Values		Comments
0.1 erythema dose/y ( 1R/wk for 200 kV X ray	52 R/y	1925: Recommended by A. Mutscheller and R. M. Sievan 1934: Recommended by ICRP and used worldwide until 195
0.1 R/day (or 0.5 R/wk)	36 R/y	1934: Recommended by NCRP
0.3 rem/wk	15 rem/y	1949: Recommended by NCRP 1950: Recommended by ICRP for total body exposure
5 rem/y	5 rem/y	1956: Recommended by ICRP 1957: Recommended by NCRP for total body exposure

FOR MEMBERS OF THE PUBLIC

Recommended Values		Comments
0.03 rem/wk	1.5 rem/y	1952: Suggested by NCRP for any body organ
0.5 rem/y	0.5 rem/y	1958: Suggested by NCRP 1959: Suggested by ICRP for gonads or total body
5 rem/30y	0.17 rem/y	1958: Suggested by ICRP for gonads or total body
25 mrem/y	0.025 rem/y	1977: Suggested by EPA [20] for any body organ except thyroid <sup>a</sup>
5 mrem/y	0.005 rem/y	1974: Suggested by ERDA for persons living near a nuclear power plant <sup>b</sup>

R = roentgen. 1 R=0.88 rem

rem = roentgen equivalent man

mrem = millirem

NCRP = National Council on Radiation Protection and Measurements

ICRP = International Commission on Radiological Protection

<sup>a</sup>The limit set by the Environmental Protection Agency for the thyroid was 0.075 rem per year.

<sup>b</sup>Present radiation protection guide of the Nuclear Regulatory Commission.

Therefore, a worker exposed to dust concentration of 300 micrograms per cubic meter after Dr. Warren's directive of June 1945, would have received little attention. Three-hundred micrograms would have been only six tenths of the allowable maximum. However, a worker exposed today to that concentration would be brought to the attention of health officials because that concentration--300 micrograms--would be 150 per cent of today's permitted maximum.<sup>33</sup>

Paralleling the history of allowable dust concentrations is the record of reduced maximum radioactivity exposures for workers. Whereas dust concentrations are determined by the weight of the particles in a given volume of air, radioactivity of the particles determines another aspect of the hazard for workers. Radioactivity is also a hazard even where no dust, per se, may be present.

Over the years since World War II occupational radiation standards have been lowered by a factor of 10, from 52 Roentgens per year to the present standard of five rems per year. The present five rem standard should be reduced to 2.5 rems and ultimately to 0.5 rems per year, according to Dr. Karl Z. Morgan, a founder of the science of health physics and director of Health Physics Division of the Oak Ridge National Laboratory from 1943 to 1972.<sup>34</sup> Dr. Morgan's recommendations provide a stark contrast to the finding in 1943 of Dr. G. Failla (p. 156 supra) in which Dr. Failla recommended an allowable exposure of 5.5 Roentgens per week (about 5.25 rems per week) to the hands, and a whole body exposure of .55 Roentgens per week. Given the latency period for

most cancers, it would seem that the 1940s-era exposures of workers in Western New York would have shown results by now. Their health histories, and exposure records, would represent a complete picture of whatever sacrifice they may have made as unwitting midwives of the atomic age. The Federal Government could demonstrate its concern for all workers in the nuclear industry today by making a comprehensive study of health histories of those workers from the early days of the atomic age. Such a study would be a significant contribution to the body of knowledge about this subject.

PART THREE -- THE USE AND MISUSE OF THE

LAKE ONTARIO ORDNANCE WORKS

OVERVIEW OF FINDINGS

This section of the Report will focus on the varying and successive uses by the Federal Government of the former Lake Ontario Ordnance Works ("LOOW") site, and the aftermath of federal activity -- the contamination of land, air and water on the site and off-site in the surrounding towns of Lewiston and Porter, Niagara County, eight miles north of Love Canal. Discussed in Findings V through VIII are several prominent examples of misfeasance and non-feasance on the part of the Federal Government contributing to the site's present condition.

The first major military involvement in the Region, and the subject of Finding V, was the wartime operation at LOOW of an Army TNT plant, which resulted in the contamination of part of the plant's surface area and a vast network of underground waste lines with TNT wastes and residues. According to government documents obtained in the course of the Task Force's inquiry, neither the areas above or below-ground were ever fully decontaminated. Ultimately, the land on which the TNT plant once stood was sold to private owners by the Federal Government's General Service Administration ("GSA"), apparently without any notice being provided to the new owners of the existing contamination hidden on the site. The Army's legacy of TNT contamination at the LOOW is significant today because of the potential dangers arising from whatever TNT residues may remain

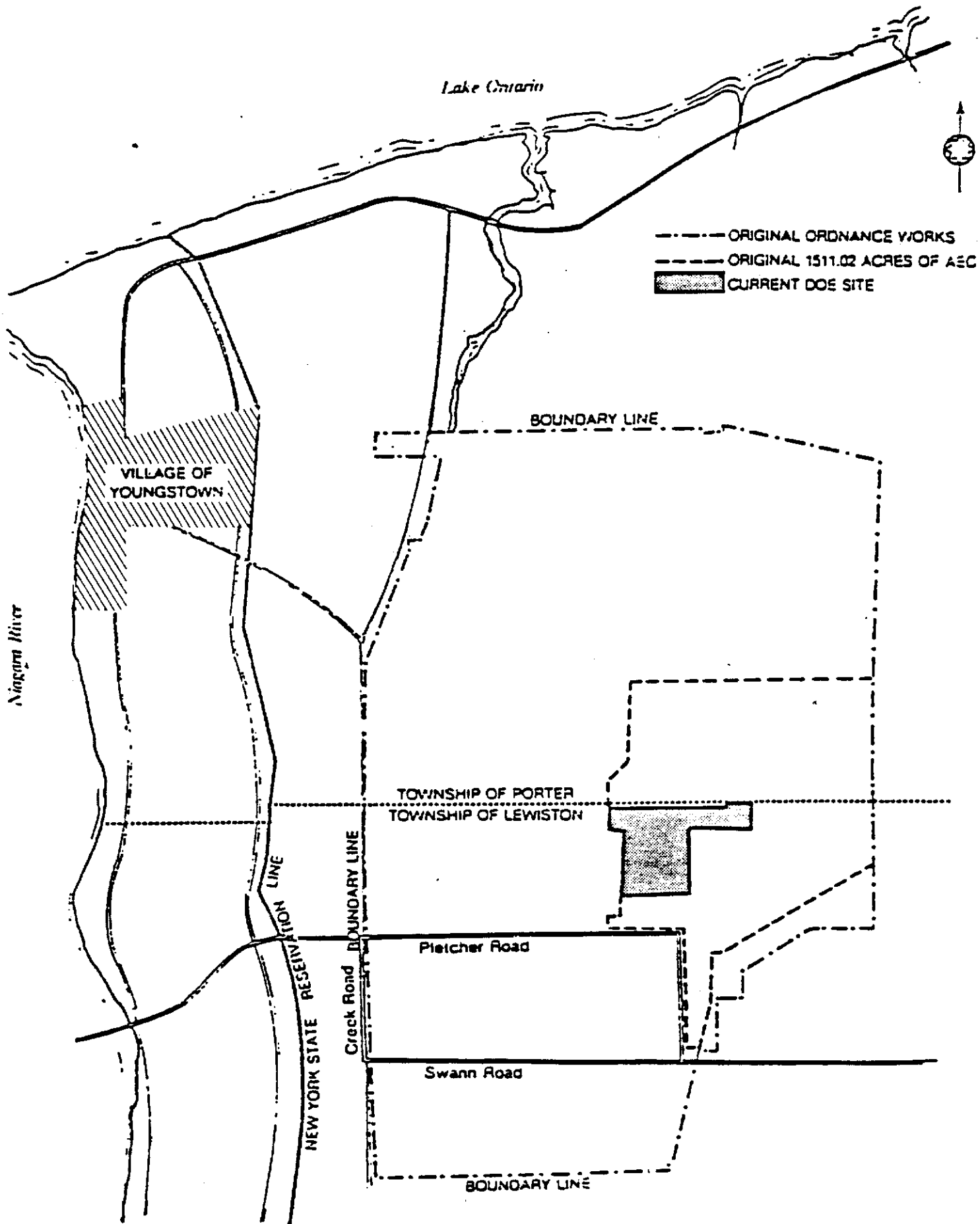


FIGURE 7 - Original Lake Ontario Ordnance Works and Present DOE Site  
(Source: Department of Energy 1979)



in the waste lines. Given the former TNT plant site's present use as a privately owned landfill and treatment facility for highly toxic chemical wastes, further exploration of the possible hazards at the site is mandated.

The second significant federal use of a section of the LOOW site, the subject of the Task Force's sixth finding, was as a storage and disposal center for radioactive materials and wastes from the Manhattan Project and subsequent atomic research and weapons production programs. The radioactive materials buried and stored at the LOOW have created a continuing problem over the past thirty years by migrating off the site through the air and through the surface drainage system. Currently the subject of a federal "remedial action" plan, parts of the former LOOW site have been repeatedly surveyed, although the precise extent of the contamination on and off the site has yet to be fully determined. For the first time, at least, conditions at the site are the subject of close public and federal scrutiny.

Part of the LOOW story that has never been told, prior to this Report, is the way in which the conditions at the LOOW were created and fostered by federal policies. Documentary evidence compiled by the Task Force discloses the extent of federal mismanagement at the site, as it was manifested by sloppy record-keeping procedures, inadequate mapping of buried wastes, and technological primitivism with regard to waste storage and disposal. Perhaps most surprising was the LOOW's haphazard evolution into a radioactive waste storage and disposal ground.

In light of its poor drainage and significant levels of precipitation, the LOOW site was singularly ill-suited for use as a storage site. An AEC official was later to recollect that the choice of the LOOW site hinged more on availability rather than any unique features making it suitable for storage of radioactive materials. Expediency and economy were the principal determinants of the federal storage and disposal program. This "program" included, among other things, the dumping of radioactive wastes in open, and often unmapped pits, in rusting barrels stacked along the road side, and in inadequate structures originally designed for much different purposes. Inevitably, these practices resulted in the contamination of the LOOW site and in the leaching of radioactive contaminants off the site, onto land outside of the control of the Federal Government.

Compounding the problem was the lack of information provided to local and state health and environmental officials and to the public regarding conditions at the LOOW. Government documents reveal that, on several occasions, federal officials misled local government representatives and the public concerning the nature of federal activity at the site, and the extent of the radiological hazard at LOOW. The result of this deception was to discourage local and state review of federal activities at LOOW and to delay the necessary state action later taken to protect the neighboring community from AEC-induced contamination.

The Task Force's seventh finding also concerns the LOOW, but involves the dumping of chemical, as opposed to radioactive waste. Government documents obtained by the Task Force evidence

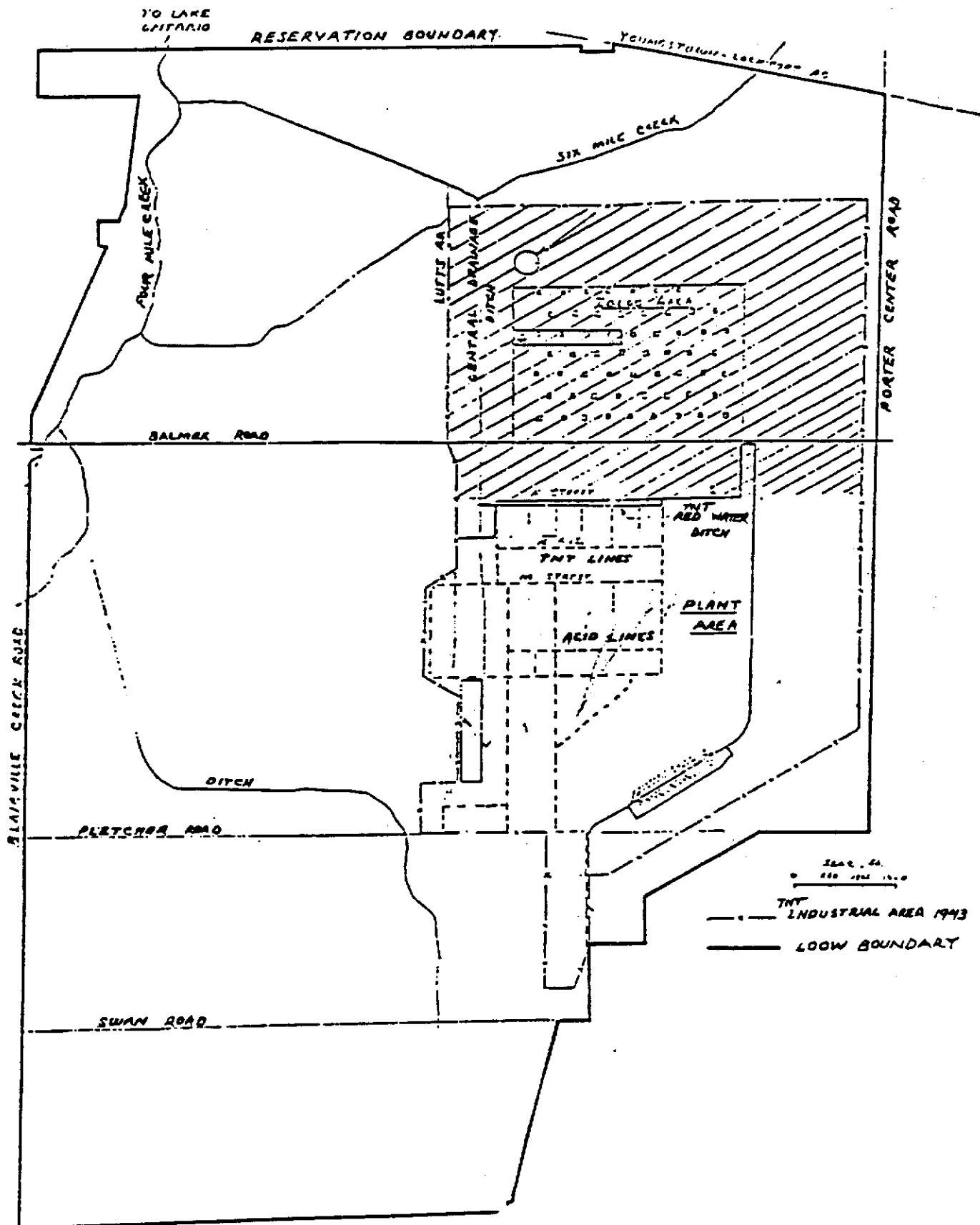
that high AEC officials explicitly sanctioned the disposal of thousands of gallons of untreated thiocyanate waste directly into the LOOW outfall sewers. The waste, generated by an AEC contractor, Carborundum Metals Co. was dumped free of charge, and was carried by the LOOW sewer to the Niagara River, ultimately reaching Lake Ontario. Not surprisingly perhaps, no record of this disposal operation was provided to the Interagency Task Force on Hazardous Wastes during their 1979 review.

#### HISTORY OF LOOW USES

In order to better appreciate the Task Force's findings with regard to the LOOW, a discussion of their historical context is appropriate.

##### TNT Plant

Federal Government activity at the Lake Ontario Ordnance Works began in early 1942, with the Army's acquisition by condemnation of 7,567 acres [see Figure 7] from 149 private landowners, many of whom were farmers and orchard growers.<sup>1</sup> Reportedly, much resentment was caused when the Army gave the farmers 30 days notice to move out, permitting them only to harvest crops already planted.<sup>2</sup> To make way for the construction of a TNT (trinitrotoluene) plant most of the 125 farmhouses and 538 barns on the site were burned down or demolished, although some of the existing structures were converted to Army use.<sup>3</sup> Construction of "the TNT", as it was known to local residents, began in January 1942, and was a massive undertaking. Over 7,500



**FIGURE 8 - L.O.O.W. TNT Plant**  
(Source: U.S. Army 1979)

workers were involved in the plant's construction, building 33 miles of roads, over 500 structures, a power plant, hospital, fire department, and a water supply system adequate for a city of 100,000.<sup>4</sup> Many of the buildings constructed, some of which remain standing today, were designed to look like barns from the air, so as to fool enemy spies.<sup>5</sup> Construction of the plant was undertaken with great urgency. A memorandum from the plant's military commanders advised all Army personnel in the interests of expediting the production of TNT, to "bend every effort to achieve earlier and greater production"<sup>6</sup>

Although the reasons for selection of the site are not clearly established, it is probable that they included the same factors which had made the Niagara Frontier the home of the chemical industry -- abundant water and cheap power. Physically, the large tract enabled the Government to construct a plant surrounded by thousands of acres of "security area." The site also had access by rail for the transport of raw materials and the shipment of munitions in their finished state. Its relative proximity to an urban labor market was also an important factor.<sup>7</sup>

Although the site had some natural advantages, it also had drawbacks, primarily with terrain and climate, which delayed construction timetables and proved years later to be a dominant factor in terms of the environmental hazard created by activities at the site. Harsh winter weather, with high winds, heavy snow and low temperatures combined with severe flooding and poor weather in the spring to inhibit the construction and operation

of the plant.<sup>8</sup> Due to unexpectedly poor soil conditions, structural changes in the plant's buildings were required and foundations increased because of the inability of the clay soil to bear the heavy industrial structures. Additional difficulties were encountered in laying roadways, railroad track, and in finishing electrical work at the site during the winter of 1942-43.<sup>9</sup>

Operations by the Army's contractor commenced, even before the plant was fully complete, on October 1, 1942. There were six TNT lines at the LOOW, with a daily capacity of 390,000 pounds.<sup>10</sup> The manufacturing of TNT was done in the section of the LOOW south of Balmer Road, while the storage of explosives was accomplished in the reinforced concrete magazines (called igloos) constructed in the area north of Balmer Road.<sup>11</sup> [See Figure 8]

The TNT plant at the LOOW did not stay in operation for long. Apparently, the Army had grossly overestimated its need for TNT. Thus, after barely nine months of operation, and the expenditure of an estimated \$27 million for the facility, the plant ceased operation in late July 1943.<sup>12</sup> As discussed infra, one lasting result of the LOOW's brief use as a TNT plant was the contamination of buildings, grounds and waste lines with potentially explosive TNT wastes and residues.

#### Manhattan Project and Chemical Warfare Service Activities at the LOOW

After the production of TNT ended at the LOOW, the site quickly came into demand for other uses. The Manhattan Project, in the midst of constructing a gaseous diffusion plant in Oak Ridge, Tennessee, cannibalized LOOW's water system and piping and

shipped them to Oak Ridge where this equipment was greatly needed.<sup>13</sup>

The Chemical Warfare Service also found the LOOW site attractive. As discussed infra, at pp. 72, in the 1944-1946 period, it redesignated 1,100 acres of the LOOW as the Northeast Chemical Warefare Depot, and used the site for the temporary storage and transshipment of munitions and chemicals.

The subsequent use of the LOOW site which perhaps has had the most significant long term impact began in February 1944, when the Manhattan Engineering District ("MED"), the Army unit responsible for the Manhattan Project, was granted use of a large concrete reservoir and 25 surrounding acres in the Baker-Smith area of the LOOW. [See Figure 13] The LOOW site was ideal for MED's purpose, which was to store the radioactive sludges (known as L-30 and L-50) generated from the uranium ore refining process located at the Linde Air Products "Ceramics Plant" in nearby Tonawanda, New York.<sup>14</sup> The location of the LOOW site was convenient, and its selection expedient. Situated only a few miles from the Linde plant, the site was relatively isolated and secure, could be obtained at little or no cost, and had existing structures which could be readily converted to MED uses. The original "permit for use" which was granted to MED was conditioned on the requirement that the "future use" of the LOOW concrete reservoir not be impaired for the storage of water.<sup>15</sup> However, this promise was not kept. Typifying what was to become the standard pattern of operation at the LOOW, the irreversible contamination of the reservoir and the Baker-Smith areas was used

to justify the expanded use of the LOOW site by MED (which by this time had become the Atomic Energy Commission. An April 9, 1948 AEC letter admitted that MED's storage of "contaminated materials" at the site had contaminated the reservoir to "such a degree that it is impractical and uneconomical because of a potential health hazard to decontaminate and restore to its original condition." AEC also conceded that "slight contamination" existed in the surrounding area then owned by the Army.<sup>16</sup> This area was at the time being offered for public sale. The "solution" adopted by the Army, which avoided the necessity for decontamination, was to continue using the permitted areas and to radically expand AEC's operations onto 1,517 acres of the LOOW site.<sup>17</sup> [See Figure 7] The AEC plot encompassed the area previously used as a TNT plant and as a storage depot for the Chemical Warfare Service.<sup>18</sup>

Once its use as a radioactive waste dump was established, the LOOW became one of the AEC's principal storage and disposal areas on the East Coast. Various types of waste and contaminated equipment from wartime plants were stored and/or buried at the site, as discussed in greater detail infra at pp 223. In addition, in the early 1950s, incoming and outgoing uranium and thorium "billets" from the nearby rolling plants at Simonds Saw and Steel and Bethlehem Steel were temporarily stored at LOOW.

Succession of Post-War Uses

Various federal agencies and branches of the armed services

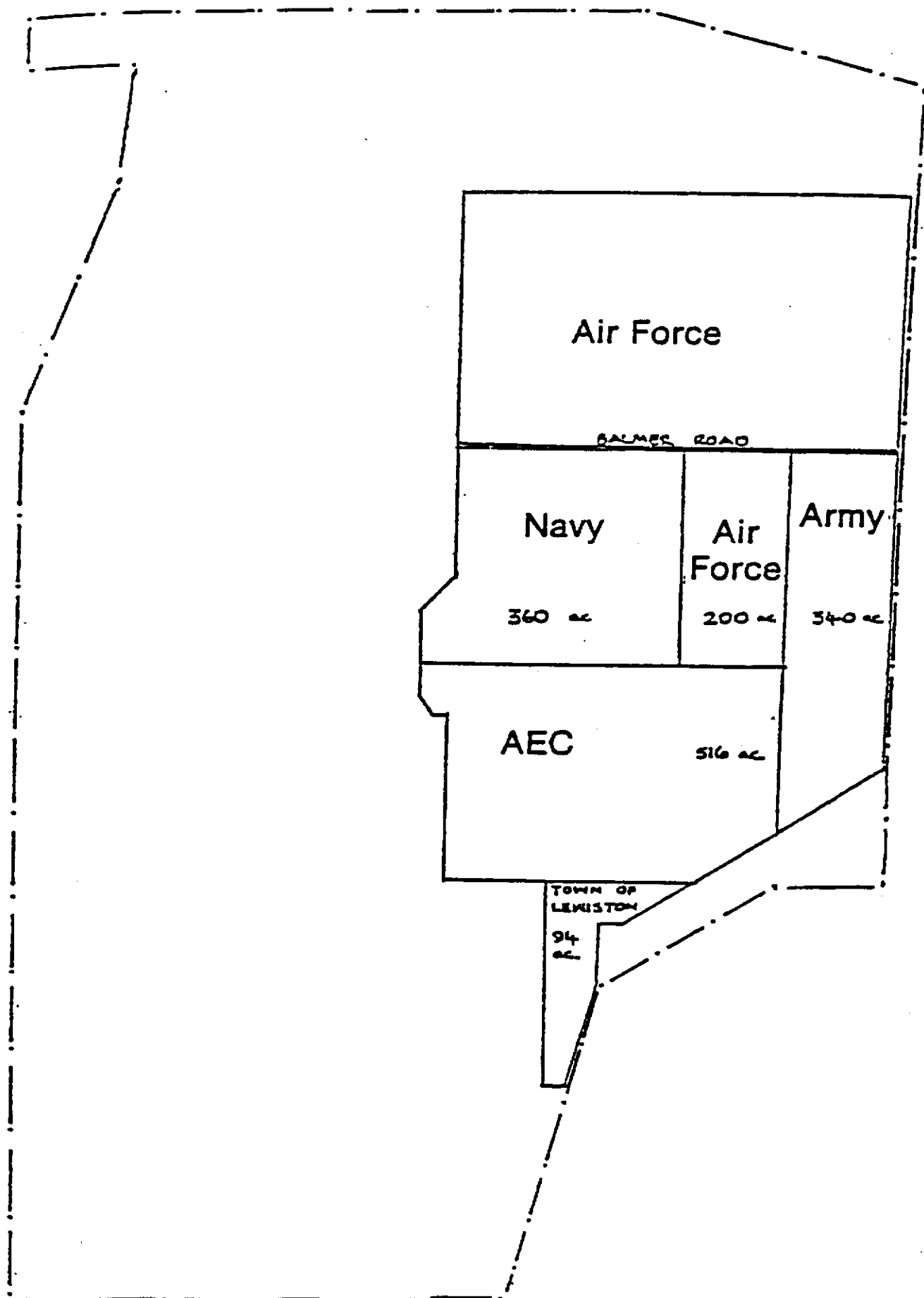


participated in the carving up of the original 7,500 acre LOOW site. In early 1946, 5,000 acres comprising the northern and western portions of the site were declared "surplus" to government needs, transferred to the War Assets Administration and Farm Credit Administration, and eventually sold to private owners.<sup>19</sup> It was initially hoped that the land could again be used for farming and orchards. The Niagara Gazette acerbically reported, at the time of the TNT plant closing in 1943, that some of the farms where "government engineers did not lay their hands" would soon be back to producing wheat and corn. The hope was also expressed that:

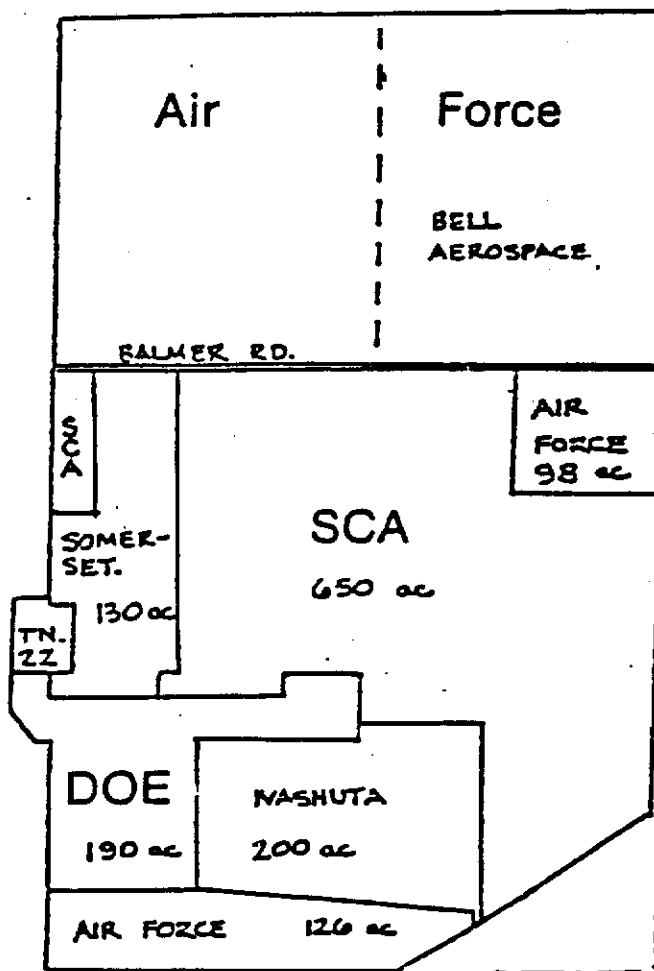
"Peach and cherry trees, not cut down in the rush of feverish necessity, are expected to bloom again in the spring and again bear their much publicized Niagara County fruit."<sup>20</sup>

Unfortunately, many of the farms and farmhouses destroyed by the Army were not rebuilt by the new private owners. Similarly lost were many of the orchards at the site, whose trees, due to lack of care, had withered and died.<sup>21</sup> There was no going back to the bucolic, pre-war days, at least not while the AEC, Army and Air Force still had designs on the LOOW site.

In 1953-1954, AEC contracted with Hooker Electrochemical to build and operate a boron isotope separation plant at LOOW, at a construction cost of over \$5,000,000. The plant operated until 1958, when it was placed on stand-by. It was reactivated from 1964 to 1971 and was again placed on "stand-by" in 1974, the status in which it remains today.<sup>22</sup> Reportedly, no hazardous or radioactive materials were associated with the project.<sup>23</sup>



**FIGURE 9 - L.O.O.W. 1955**  
(Source: Parry Report 1979)



**FIGURE 10 - Former L.O.O.W. 1972**  
(Source: Parry Report 1979)

The Department of Energy presently occupies 190 acres of the former LOOW site, an area now designated as the Niagara Falls Storage Site. [See Figure 7] It is on this site that the radioactive waste from the Manhattan project and other AEC operations are still stored or buried.

Beginning in 1955, part of the "igloo area" from the original TNT plant was reacquired by the Army and reportedly used for "the consolidation of liquid fuel components" for Nike Ajax rockets and for the incineration and detonation of conventional munitions and explosives.<sup>24</sup> [See Figure 9] In 1957, at a cost of \$25 million, the Army constructed a Nike ground-to-air missile base consisting of 36 anti-missile missiles. The battery was one of seven built to defend the Niagara Hydroelectric Power Project. It was deemed obsolete and decommissioned in September 1964.

In 1965, 98 acres from the former missile site were transferred to the Air Force for the construction of the "Youngstown Test Annex". A nearby 126 acre plot, in the southern part of the former AEC site, became the Ransomville Test Annex. Both bases were part of a defense communications range. The Ransomville site was closed in 1976. The Youngstown base remains in operation to this day.<sup>25</sup>

The Air Force also presently owns a large 871 acre section of the former LOOW site located north of Balmer Road. The Air Force and Army National Guard utilize the site, on which the igloos are located, for training and equipment and munitions storage.<sup>26</sup> [See Figure 10]

An adjacent 434 acre plot is the site of Air Force Plant 38. This facility has been operated by Bell Aerospace since 1942 and is presently involved with the production of rocket propulsion hardware and lasers.<sup>27</sup>

The subsequent disposal history of the land on which the TNT plant's acid and nitration areas were situated is the critical question here, since, as discussed infra, government reports in 1946-1948 identified these areas as heavily contaminated. The AEC inherited the TNT production areas, located south of Balmer Road, from the War Assets Administration in 1948, but transferred them back to GSA as surplus in the early fifties. Throughout, AEC continued its operations in the site's southwest portion. In 1955, the Navy acquired 360 acres and the Air Force 200 acres of the former LOOW site [see Figure 9], parcels which included the site on which the contaminated TNT plant once operated. The Air Force acquired the Navy's area when it took over the joint Navy/Air Force project which involved the manufacture of high energy fuel. Designated as Air Force Plant 68, a \$45 million plant, including 79 structures, was constructed on the site by the Air Force's contractor, Olin Mathieson. However, due to changing Air Force requirements, Olin's pilot plant was closed in 1959 before the main plant was even completed.<sup>28</sup> In 1966, Air Force Plant 68, along with other AEC property, was declared surplus and transferred to GSA for disposal.<sup>29</sup> Part of the property, including the former TNT plant acid and nitration areas, was then sold to a real estate syndicate, the Fort Conti Corp., for \$97,580, and to other private owners. Fort Conti sold

a part of its property to Chem-Trol Pollution Services in 1972 and the rest in 1976 for a total price of \$534,000. Chem-Trol's successor, the Services Corporation of America ("SCA") presently operates a chemical waste treatment and disposal plant on the site.<sup>30</sup> [See Figure 10].

The crazy-quilt of land use at the LOOW since 1942, of which only a thumbnail sketch is provided above, is itself a fascinating story. Professor David Parry, who has studied the LOOW site, estimated that all told, the Federal Government spent over \$150 million in the 1940s and 1950s for the construction and operation of its various projects at the site.<sup>31</sup> As discussed in the succeeding sections, the hidden costs for proper decontamination of the site are only now being assessed.

## FINDING V

THE ARMY'S TNT PLANT AT LOOW WAS NEVER SUFFICIENTLY DECONTAMINATED, LEAVING AN UNCHARTED LEGACY OF TNT WASTES AND RESIDUES IN AN AREA NOW OCCUPIED BY A CHEMICAL WASTE LANDFILL AND TREATMENT FACILITY

Documents obtained from Federal Government archives and agency files evidence that the Army's former TNT plant at the Lake Ontario Ordnance Works was never fully decontaminated and was ultimately sold to private owners without notice being provided of the possible existing contamination of the plant's underground waste lines and surface area. A tripartite discussion of this finding follows. First explored is the contaminated condition of the former TNT plant, as attested to by surveys and reports from the 1944-1948 period. Second, the LOOW site's disposal history is examined, and it is seen how the warnings concerning the site's contaminated condition were ignored and eventually forgotten by the Federal Government. The third part of the discussion herein considers the potential significance of residual TNT contamination at the LOOW, in light of the site's present use as a treatment plant for chemical wastes, and the potential for similar contamination at other former military facilities located throughout the country.

### A. CONTAMINATION OF THE LOOW WITH

#### TNT WASTES AND RESIDUES

An Army 1979 study stated that the wastes generated by the manufacture of TNT at the LOOW site, included "low grade TNT, TNT contaminated refuse, waste acid and a sulfunated unsymmetrical TNT by-product"<sup>32</sup> During the plant's period of operation,

TNT-contaminated wastes were reportedly burned at the site, while unknown quantities of nitric and sulfuric waste acids were neutralized with lime and discharged through the plant's sewers to the Niagara River.<sup>33</sup>

#### Disposal of Trade Waters

One of the most difficult waste disposal problems confronting the civilian and military personnel designing the TNT plant in 1942 was the disposal of the red and yellow-colored liquid wastes produced in the TNT process. These highly acidic and toxic effluents contained particles of TNT and other residues. In a document reviewing the TNT plant's history of construction, the plant engineers noted that the designer of the process, duPont, had specified two possible methods. The first method was to incinerate the waste, which was "extremely expensive" and time-consuming since it was required evaporation of the liquid waste prior to incineration. The second method, ultimately embraced with great enthusiasm, was to dilute the trade waters with "sufficient quantities of water ... to reduce the color and to eliminate the toxic effects" and then to discharge the waste into an open surface drainage ditch which led to Four Mile Creek and ultimately to Lake Ontario.<sup>34</sup> An early LOOW design document observed hopefully that:

"The dilution would be of the order of one part in a million, which<sup>35</sup>probably will make such a disposal entirely safe."



The disposal of toxic wastes directly into Lake Ontario resulted in considerable savings, amounting to \$800,000 in capital costs and \$125,000 yearly. The proximity of Lake Ontario, which allowed for the disposal of these wastes, was one of the great advantages of the LOOW site. This advantage was apparently not shared by other similar TNT plants around the country whose liquid wastes had to be incinerated.<sup>36</sup>

The disposal of approximately 130,000 gallons per day of trade waters into Lake Ontario<sup>37</sup> was, in the short-term, an inexpensive method of waste disposal. It was not entirely effective, however, since the dilution of the liquid wastes did not occur until after the wastes had passed through the underground waste lines in the plant's nitration area. Thus, deposited in the waste line were TNT particles and residue's which were both toxic and potentially explosive.

#### Government Reports Find TNT Contamination At LOOW

The extent of contamination at the LOOW TNT plant was recognized fairly soon after the war's end, when the disposition of surplus government property at the site was considered by the War Assets Administration ("WAA"), the federal agency charged with the disposal of wartime properties. A WAA official who inspected the former TNT plant was informed that:

"the Nitration Area, the Magazine Area and the Sewage System were contaminated to the extent that smoking, driving of an automobile, or any other fire hazard are not permitted..."<sup>38</sup>

The Army Corps of Engineers confirmed the existence of contamination at the site, when it advised WAA, early in 1947, that:

"no additional decontamination of the soil is to be undertaken and no effort made toward the removal of explosive waste deposited in certain of the plant sewers pending the disposal of this installation. In the event that the plant is disposed of to a concern engaged in similar manufacturing, it is not anticipated that decontaminating will be required."<sup>39</sup>

A second appraisal of the LOOW site by the WAA in October 1947 [see Appendix] highlighted the extent of contamination from the short-lived TNT plant, and the fact that thorough decontamination would be costly. The plant's "Central Area" (the TNT and Acid areas), the report stated:

"is highly contaminated. The soil is impregnated with dangerous combustible and corrosive acids from residual TNT materials. Below grade extensive pipe (iron) lines interlace these areas and can never be fully decontaminated or safely removed except at considerable cost."<sup>40</sup>

Due to residual TNT contamination, public roads bordering the LOOW site, which were off limits during the war, remained closed. A WAA press release in January 1948 [see Appendix] explained to an unhappy public that the roads were temporarily restricted due to the "definite" presence of "sizable pieces of TNT" in the area "south of Balmer Road and east of Lutts Road." Surface contamination at the LOOW site was persistent and widespread, the WAA press release observed:

"While two attempts have been made to decontaminate these areas, nevertheless fresh rains and erosion continue to expose more TNT. The area is particularly dangerous in that the TNT is waste, and impure TNT and is more explosive than pure TNT"<sup>41</sup>

WAA promised to erect a climb-proof fence around the contaminated area to permit the reopening of the roads to the public.<sup>42</sup>

The contaminated condition of the TNT plant also explained WAA's consistent refusal in 1947 and 1948 to dispose of certain sections of the LOOW to private owners prior to the proper decontamination of these sections. Numerous inquiries from the public regarding the lease or sale of LOOW land were rebuffed by WAA for this reason, with the explanation that:

"certain areas are contaminated with explosive chemicals<sup>43</sup> which constitutes a potential danger to the public."

A May 12, 1947 letter from WAA to a private corporation cited the "large scale of contamination which still exists at the plant" as the factor delaying disposition of the plant and its equipment.<sup>44</sup>

As pressures to dispose of the surplus LOOW property increased, WAA realized that it lacked definitive information regarding the extent of contamination at the site, information necessary in order to responsibly dispose of the property. An internal WAA communication dated February 26, 1948 complained that "this office has never been informed [by the Army] as to the extent of decontamination at subject facility."<sup>45</sup> In an apparent effort to remedy its lack of knowledge concerning the portions of the LOOW site it had blindly inherited from the Army, WAA commissioned a private consultant to study and appraise the property. The assignment of the consultant, the Industrial Research Corporation ("IRC"), was to extensively inventory and survey the site, to determine the extent of remaining

contamination and to recommend methods for further decontamination.<sup>46</sup> The importance of this study warrants the following detailed discussion of its findings and recommendations.

#### The 1948 Appraisal - A Turning Point

Doubtless, the 1948 IRC report confirmed WAA's worst fears. Large portions of the TNT plant, said the appraisers, should virtually be condemned for any use:

"It is our opinion that 100% decontamination is almost impossible in these concentrated manufacturing areas and that particularly the lower sections of each of the TNT areas should be condemned for future use and fenced and posted accordingly."<sup>47</sup>

Indeed, although the TNT plant had been "decontaminated" by the Army, the results achieved, the IRC found, left much to be desired. In accordance with the then applicable War Department regulations, the LOOW site had been decontaminated to a condition of "idle standby".<sup>48</sup> This standard represented a "half-measure" of decontamination; that is, decontamination only to the extent that the site could again be used as a TNT plant.<sup>49</sup>

However, since WAA was contemplating returning the LOOW site to its original use as farmland and orchards, IRC appraised the site with these alternative uses in mind. It found that if the land were to be used for other than a TNT plant, the Army's decontamination program was seriously deficient, in three principal respects:

- 1) the ground surface area and drainage ditches were contaminated with TNT and TNT residues;

- 2) buildings and equipment at the site had been improperly decontaminated; and
- 3) underground waste and sewer lines at the plant were contaminated with TNT and TNT residues.

### Surface Contamination

Little attempt had been made, the IRC report noted, to decontaminate the grounds in the explosive production areas, with the exception of the removal of large chunks of TNT.<sup>50</sup> IRC also reported that samples of soil analyzed from areas surrounding the plant's drainage ditches and wash house indicated that these areas were still contaminated. TNT residues had been washed by rains and erosion to the surface, particularly at the lower end of all TNT lines.<sup>51</sup> The condition of the grounds and ditches created a "known hazard", stated the IRC report, which a final decontamination program would have to address.<sup>52</sup>

### Army Decontamination Methods Criticized

The IRC consultants also found many of the Army's methods and procedures for decontamination ineffective, stating that:

"boiling, steaming and washing of buildings and equipment does not destroy or desensitize TNT. TNT melts and the oil (molten explosive) may penetrate into openings<sup>53</sup> and solidify on cooling, thus creating a hazard.

The methods used by the Army, said the IRC, at best only removed the explosives from the surface, possibly moving them "from plain view into hidden crevices."<sup>54</sup> Burning of the residues, the IRC recommended, was the only assured method for decontamination. In light of the Army's inadequate efforts, the

IRC warned that the buildings "decontaminated" in 1945 by washing and cleaning were not to be considered safely decontaminated for removal from the premises.<sup>55</sup>

There is some indication that the Army's decontamination methods were not only ineffective, but also dangerous. For example, the Army's flushing of the underground waste lines and sewers with a caustic solution (soda ash)<sup>56</sup> may have significantly increased the explosive hazard at the site. This treatment, according to an explosives expert consulted by the Task Force, may have actually tended to destabilize the TNT rather than to neutralize it.<sup>57</sup>

#### Contaminated Waste Lines -- A Known Hazard

The third known hazard threatening the LOOW site emanated from the interlacing network of waste water lines buried one to fourteen feet beneath the surface of the site. These lines, which were thousands of feet in length, were believed to be coated with wastes from the explosive manufacturing process, which included waste from TNT neutralization, TNT waste treated with sodium sulphide, waste from sodium carbonate purification from washing and melting TNT, as well as mono, bi-and trinitrotoluene.<sup>58</sup> It was ominously noted by the IRC that the combination of these relatively stable explosive wastes could form a very unstable and powerful explosive material, tetronitromethane.<sup>59</sup> Thus, if any of these lines were to be removed, it was cautioned they had to be handled with "extreme care". The extent of this "condition", underscored the IRC appraisers, "cannot be overemphasized".<sup>60</sup> To reduce the danger

of explosion, it was advised that while being moved, the lines be kept thoroughly wet. Even this method was not guaranteed to prevent explosions and "flashing". Workmen were cautioned to keep away from the open end of the pipes:

"as there are greater dangers of flashes than of explosion, although high order of detonation is highly possible and has been known."<sup>61</sup>

In addition to contamination of the waste lines, the IRC report noted the likelihood that underground sewer and drain lines from the TNT areas, explosive laboratories and laundry could also contain various explosive compounds.<sup>62</sup>

Recognizing that the proposed land disposal program for the LOOW did not contemplate removal of the underground lines, the IRC nevertheless deemed it prudent to outline the potential hazards:

"in order that the conditions may be realized and surface operations covered accordingly."<sup>63</sup>

#### Other Possible Hazards Forseen

In addition to describing certain "known hazards" at the LOOW, the IRC report outlined 7 "possible hazards...attendant" to TNT plants generally which should be considered in formulating a decontamination and disposal plan. They included:

- "(1) Danger of detonation by impact against surface TNT or isomers by vehicle, tool or shoe;
- (2) Danger of fire from cigarette, match or spark;
- (3) Danger of inexperienced person or youth picking up an accumulated quantity of explosive;
- (4) Danger of detonation when digging a well, post holes, foundation or possibly when plowing;

- (5) Danger of fire or explosion resulting from spontaneous combustion;
- (6) Danger of detonation when dismantling buildings;
- (7) Possibility of detonation of materials shipped from plant."<sup>64</sup>

While conceding that the possibility of accident from these dangers was "remote", the report urged that the existence of these "potential hazards not be omitted from plans for future disposition of the property."<sup>65</sup> Unfortunately, as the discussion in the succeeding sections demonstrates, the federal government's knowledge of these conditions had surprisingly little impact in determining the course of future operations at the site.

#### IRC Recommendations To WAA

Extensive recommendations were made by the IRC appraisers concerning the nature of and preferred methods for the decontamination work still required. A "great deal of decontamination work remains to be done", the IRC advised, if the plant were to be used for processes other than explosives manufacturing.<sup>66</sup> In some heavily contaminated areas of the TNT plant, 100% decontamination was "impossible", the report asserted and remedial action did not make economic sense. The expense of removing contaminated soil, burning the residues, and refilling the area was so prohibitive, it was suggested, that the area should simply be fenced and abandoned.<sup>67</sup> Similarly, the "very serious" problem with the underground waste and sewer lines could not cheaply be remedied. Proper safety precautions would



require removing or breaking these lines, then reaming and flushing them out to remove any explosive deposits. However, this procedure was quite laborious and expensive, and would prevent future use of the LOOW as a TNT plant. The IRC cautioned that if the lines were not removed, at the very least their location should be carefully marked for future reference and the content of the lines analyzed where they crossed areas of public access.<sup>68</sup>

#### B. DISPOSAL HISTORY OF LOOW AND IMPACT OF CONTAMINATION SURVEYS

As shall be seen in the succeeding section, the words of caution of the IRC and other experts were not heeded by the Federal Government nor reflected in the site's subsequent disposal history. The institutional awareness of contaminated conditions at the LOOW, so keen in 1947 and 1948, quickly faded and was soon forgotten by the succeeding generations of bureaucrats.

Shortly after the war's end, a large portion of the LOOW (5,206 acres), the so called security area, was disposed of to private individuals, some of whom were the original owners.<sup>69</sup> The remaining 2,326 acres of the LOOW (excluding the Manhattan Project's 30 acre reservation) were declared surplus by the Army. In a January 13, 1947 document, WAA, the agency responsible for the sale of surplus government property, classified the "best economic use" of the site as agricultural, while noting that "possible chemical contamination" might restrict its "immediate use" for this purpose.<sup>70</sup> Perhaps reflecting its more intimate awareness of the site's contaminated state, the War Department

contemplated a vastly different disposal program for LOOW. The War Department's formal "declaration" to WAA stating that the remaining LOOW property was surplus to its needs was ironically dated on the same day as the WAA's classification of the property as "agricultural". In that declaration, the Corps of Engineers previous decontamination efforts at the site were described:

A decontamination program was initiated but was not completed as it was determined that it would be to the advantage of the Government to defer this program until the property is disposed of. It is reasoned that in the event the manufacturing area is disposed of to a concern manufacturing chemicals, decontamination would not be required.<sup>71</sup>

In accordance with its pre-disposal procedures, WAA requested on January 24, 1947 that the Corps of Engineers produce the "Decontamination Certificate" for LOOW and a copy of the site's "decontamination log" evidencing the work performed.<sup>72</sup> Incredibly, WAA had to repeat the same request in letters dated March 4th, March 31st, April 24 and June 10, 1947.<sup>73</sup> Much to WAA's annoyance (since it delayed disposal of the property), the Corps of Engineers did not respond to WAA's repeated and urgent communications until the request for decontamination documentation was finally made "on the Washington level".<sup>74</sup> The "Decontamination Certificate" for LOOW, produced at last by the Army on August 8, 1947 [see Appendix] was remarkable in its simplicity. Undated, signed by a Lt. Col. C.W. Meldrum of the Army Ordnance Department and addressed "to whom it may concern", the Certificate provided:

"This is to certify that, on 10 May 1944, the date on which the Lake Ontario Ordnance Works was turned over to the Corps of Engineers by the Ordnance Department,

the entire facility had been placed in an idle stand by condition for use<sup>75</sup> in its original purpose in accordance with PR-&-A-304.

This was to be the extent of the "information" provided by the Army to WAA concerning the contaminated state of the former TNT facility. With the transmittal of the certificate, WAA was advised by the Chief of Army Ordnance that the decontamination log documenting the work performed at LOOW was not "available".<sup>76</sup> It apparently had been "mislaidd".<sup>77</sup> WAA officials were later to object that although the certificate affirmed that the TNT plant had been decontaminated in accordance with Army requirements, WAA was never advised as to the extent of decontamination at the site or whether a public hazard would be created if the roads surrounding the plant were opened.<sup>78</sup>

By its very terms, the Decontamination Certificate for LOOW was a magical creation. Although undated, it appeared to have been written in 1947, rather than 1944 or 1945, when the decontamination work was theoretically performed. Second, the certificate referred only to the site's condition in 1944, prior to use of a portion of the site in 1944-1946 by the Chemical Warfare Service ("CWS") as a depot and storage center for CWS munitions. Since the condition of the site could have changed appreciably in three years, both from CWS activities<sup>79</sup> and the effects of weathering, the Army's certification was obsolete at the time it was provided.

In any event, the Army's "Decontamination Certificate" for LOOW made it clear to WAA that additional decontamination was required before the LOOW site could be disposed of and used for

purposes other than a TNT plant. The pressing question was who was responsible for decontamination the site. The principal conflict, as always, was over money. Pursuant to the existing agreement between the War Department and the WAA, "complete" decontamination by the using agency was not required. The level of decontamination required to be performed and paid for by the using agency was only to "standby status". Standby status meant that the property was decontaminated to the extent that it could continue to be used for its original purpose, in LOOW's case, as a TNT plant. Any additional decontamination work performed had to be done on a "reimbursable basis". WAA reported in March 1947 that no funds were available for reimbursing the owning agency for complete decontamination of any post-war installation<sup>80</sup>. Thus, it was not surprising that "little appreciable progress" in decontaminating the facility had been made by late October 1947, when the Army Corps of Engineers formally vacated the site, and WAA assumed accountability and responsibility.

#### New WAA Policy - Decontamination by Purchaser?

It was about this time that a new disposal plan for various surplus ordnance plants was developed by WAA which it hoped would avoid the necessity for further decontamination by the Federal Government. Since WAA did not have the funds to completely decontaminate the numerous ordnance plants around the country, it planned to sell the plants in their contaminated state to industrial buyers qualified to perform the decontamination work themselves. War Department technicians would, on a reimbursable basis, observe the decontamination work being performed and report any deficiencies in the work to WAA.<sup>81</sup>

## WAA Report to Congress

A December 23, 1947 WAA Report to Congress entitled "The Disposal of Contaminated Explosive Plants"<sup>82</sup> outlined the status of the plants, and the new proposed disposal scheme in detail, as it concerned eleven explosives manufacturing plants (including the LOOW) which had been declared surplus by the War Department. Disposal of the plants had proven difficult, the WAA observed, for three principal reasons. First, because these "specialized facilities for the manufacture of military explosives have no counterpart in the peacetime economy", the plants could not be operated for the purpose for which they were constructed. Second, even if they were decontaminated and converted to civilian production, the plants were unattractive from the economic viewpoint of private industry since for security reasons, the plants had been located in isolated areas. Moreover, due to the hazards of their wartime uses, the plant buildings were widely spread out and were prohibitively expensive to maintain and operate. Many of the structures were immovable or of a specialized character with no peacetime use. A third factor impeding WAA disposal was the contamination of the plants' land, buildings and equipment. This contamination comprised:

- 1) acids that could cause serious burns;
- 2) toxic vapors;
- 3) highly inflammable and explosive gases and vapors;
- 4) explosive materials;
- 5) materials constituting a serious fire hazard.

To avoid the "long and costly procedure" of decontamination, WAA had originally implemented a policy of offering the plants for sale only to buyers qualified to decontaminate them. There were

few takers, however, since WAA had made the purchaser's obligations overly burdensome. Buyers were required to purchase and decontaminate the plants in their entirety, which included contaminated equipment of dubious retail value.

The revised disposal plan set forth in WAA's December 1947 report permitted buyers to either purchase the plants outright or to make a "substantial cash payment, and divide the gross receipts from the Government."<sup>83</sup> Pursuant to this plan, the LOOW and the ten other ordnance plants were offered for sale. The contaminated condition of these facilities was prominently featured in advertisements placed in various national newspapers, including the Wall Street Journal [see Appendix]. It was noted that:

"A considerable portion of these facilities are heavily contaminated with explosives and acids, and must be decontaminated by the purchaser in accordance with ordnance procedure."<sup>84</sup>

#### Transfer of LOOW to AEC

The plan to sell the LOOW to an experienced private industrial buyer who would decontaminate it was never consummated. The Industrial Research Corp. report, dated March 4, 1948, showed significant contamination at the site, perhaps more than had been anticipated. Coincidentally, within a few weeks of the date of issuance of the IRC report, the Atomic Energy Commission requested and received permission to use the entire LOOW tract.<sup>85</sup> WAA's sticky problem with regard to disposal of the LOOW site to the public had been painlessly and inexpensively solved.

A classic rationale was offered by AEC to justify its acquisition of the LOOW site. AEC conceded that its present use of buildings located on a 30 acre parcel at the LOOW site, pursuant to an Army permit, had so contaminated the buildings that it was impractical and uneconomical to decontaminate and restore them to their prior condition. AEC also admitted that its activities had resulted in "slight contamination" of portions of the adjacent 2326 acre parcel owned by WAA. Since it was WAA's "desire", the AEC stated, that AEC "take the entire area" if any portions had to be withheld because of contamination, AEC proposed that it expand its operations into the entire area now held by WAA.<sup>86</sup> In essence, by contaminating the LOOW site through its burgeoning operations, AEC satisfied its growing real estate requirements.

The temporary "Right of Entry" granted to AEC by WAA prior to the LOOW's formal transfer indirectly acknowledged the site's contamination with TNT. The permit was conditioned on the erection of a climb-proof fence in a designated area, an area that the WAA knew was contaminated. Not surprisingly, WAA also disclaimed responsibility in the permit for injury to persons or damage to property arising from use of the property.<sup>87</sup> It is not known whether AEC officials were fully informed by WAA concerning the extent of contamination of the site. Several weeks prior to the LOOW's transfer to the AEC, a WAA engineer stationed at the site had requested that WAA's Washington office:

"advise if the T.N.T. area (from O to H streets) which has never been decontaminated above or below ground, is a hazard".<sup>88</sup>

A survey one week later recommended that the public road close to the contaminated area which was still unfenced be patrolled in order to keep out unauthorized persons.<sup>89</sup> A subsequent 1948 WAA communication stated that the AEC planned to protect the

"contaminated area bounded by Lutts, Balmer, Porter-Center and Pletcher Roads with climb-proof fences."<sup>90</sup>

#### TNT Contamination Forgotten

As far as the Task Force could determine, the preceding document contained the last reference by a federal governmental agency concerning the problem of TNT contamination at the LOOW site. Not one of the over 69,000 pages of documents received by the Task Force from the Department of Energy, many specifically concerning the LOOW site, ever mentioned or analyzed the potential hazards from surface or below-ground TNT contamination at the site or indicated that the recommended decontamination work had been preformed.

The site's subsequent disposal history, a veritable legal mosaic, contains no references, warnings or covenants concerning the site's previous uses and residual contamination. When AEC transferred the bulk of its site at LOOW to GSA in 1955, no hint was given as to any TNT contamination problems. In 1955-1956, GSA transferred 560 acres of the former AEC property at the LOOW to the Navy and Air Force for use as Air Force Plant 68. The plot included the areas of the former TNT plant described in earlier government documents as heavily contaminated. No warning or restrictions on the use of the property were given at this time; similarly, in the early sixties, when Air Force Plant 68



was declared excess and transferred back to GSA, notice of contamination was not provided. In 1966, 776 acres at the LOOW site, including the portions of the TNT acid and nitration areas described as contaminated, were sold to a real estate syndicate known as the Fort Conti Corporation. Fort Conti sold a total of 650 acres to Chem-Trol Pollution Services Inc. in 1972-1976. Chem-Trol's successor, Services Corporation of America ("SCA"), presently operates a chemical waste treatment and disposal facility on an expanded 1000 acre site and has excavated and constructed numerous lagoons and landfills on the site. Thus, the history of the site has ironically come full circle. The original post-war disposal plan of the War Assets Administration, to sell the site to a purchaser with decontamination expertise, has at last been realized.

C. SIGNIFICANCE OF RESIDUAL TNT CONTAMINATION  
AT LOOW AND OTHER FORMER ORDNANCE PLANTS

Task Force investigators originally hypothesized that the controversial covenant in the 1966 deed from GSA to Fort Conti was a veiled warning from the Federal Government concerning the site's contaminated condition. The covenant required that the owner of the property:

"not use the land...as a garbage dump and...not litter or deposit any refuse or residuals on said land that would tend to breed vermin or cause obnoxious or noxious fumes or odors."<sup>91</sup>

A question was raised in 1979 concerning whether SCA was violating this covenant by operating a chemical waste treatment and disposal facility at the site. The documents reviewed by the Task Force did not disclose the original motivation for insertion of the clause. However, there was no indication that the clause

reflected the Government's concern that the land comprising the former TNT acid and nitration areas were not to be excavated or have its surface disturbed.<sup>92</sup>

SCA is not unaware of the existence of the underground TNT lines beneath its facility. In or prior to 1978, it mapped the location of the lines in relation to its present above-ground lagoons and land-fills, using an old LOOW plot plan. According to the 1978 SCA blueprint provided to the Task Force, SCA removed or plugged some of the waste, sewer and water lines beneath its site.<sup>93</sup> Ironically, the purpose of this work was not to decontaminate or lessen the hazards from any residual TNT contamination in the underground lines. Rather, the work was performed when it was discovered that liquids, believed to be chemical wastes from SCA lagoons, were traveling off the SCA property through the underground lines and onto adjacent land. The lines were plugged in order to prevent further off-site contamination.<sup>94</sup> No incidents, such as explosions or flashing due to residual TNT contamination, were reported during the course of the remedial work performed.

#### Present Danger From Contaminated TNT Lines

A forensic expert consulted by the Task Force, Dr. James Kreuzer, a Professor of Chemistry at Siena College, reviewed the 1948 IRC Report and certain other documents relating to the disposal of the red and yellow trade waters from the TNT plant. Although he did not inspect the site, he concluded from the documents provided that there was, even today, a "slight but not insignificant danger" posed by the TNT waste lines. Dr. Kreuzer

believed that the IRC's warnings concerning the buildings and surface area of the plant were probably overstated and did not pose a present hazard. However, the lines used to carry red water, which remain beneath the SCA site were, said Dr. Kreuzer, potentially hazardous. Interestingly, he noted that the Army's attempted decontamination of the lines with soda ash, a caustic, was enough to "make a chemist turn white," since soda ash would tend to destabilize the TNT residue. Other hazards, stated Dr. Kruezer, could arise from the by-products of and intermediates in the TNT manufacturing process, such a trinitromethane and dinitrotoluene. These compounds could, he said, form explosive substances within the lines. In addition, fire or shock within the lines could result in explosions roughly "on the order of a hand grenade." Dr. Kreuzer recommended that the waste lines be decontaminated by being thoroughly soaked for two to three weeks, then lifted out of the ground by a hoist. He emphasized that cutting torches should not be used on the lines. He also advised that sediment be collected from Four Mile Creek and analyzed in order to determine whether TNT residues and by-products were present in hazardous concentrations.<sup>95</sup>

#### Further Analysis of Hazards Required

The Task Force lacks the technical expertise to determine the extent of the potential hazards at the SCA site arising from residual TNT contamination. One appropriate forum for the exploration of this issue is the presently ongoing hearing proceeding before the New York State Department of Environmental Conservation concerning SCA's permit applications. It is hoped

that expert testimony, if it is taken at the hearing, will further illuminate the issues raised herein. In addition, it is urged that the responsible federal and state officials carefully examine the site of the former TNT plant and definitively determine whether any significant contamination remains which would affect the site's present use.

#### Residual Contamination at Other Former Army Ordnance Plants

Nine other ordnance plants, in addition to the LOOW site, were publicly offered for sale in December 1947 with the explicit warning that:

"these facilities are heavily contaminated with explosives<sup>96</sup> and acids, and must be decontaminated by the purchaser.

These sites are as follows:

West Virginia Ordnance Works, Point Pleasant, W. Va.;  
Plum Brook Ordnance Works, Sandusky, Ohio;;  
Kentucky Ordnance Works, Paducah, Ky.;  
Oklahoma Ordnance Works, Pryor, Oklahoma;  
Weldon Springs Ordnance Works, Weldon Springs, Mo.;  
New York Ordnance Works, Baldwinsville, NY.;  
Gopher Ordnance Works, Rosemont, Minn.;  
Badger Ordnance Works, Baraboo, Wis.;  
Keystone Ordnance Works, Meadville, Pa.<sup>97</sup>

The Task Force has not traced the disposal histories of the above plants, nor assessed whether at these sites, in contrast to the LOOW, Army decontamination efforts were more complete. When the Industrial Research Corporation appraised these ten former ordnance works sites in 1948, it discovered that several of the sites were, like the LOOW, insufficiently decontaminated at the time they were declared surplus by the Army.<sup>98</sup> There is much to suggest that the sequence of events at the LOOW, culminating in the public sale of contaminated land, might not have been unique.

## Sale of Contaminated Land To Unsuspecting Buyers

Many of the documents obtained in the course of the present investigation reflect the raging post-war conflict between WAA and the War Department concerning responsibility for decontamination at sites declared surplus by the Army or Navy, and transferred to WAA. Despite its inadequate budget for contamination, WAA was the agency obliged to devise a solution. In several of the documents obtained, WAA officials forcefully objected to the fact that both industrial and non-industrial properties were being transferred to and disposed of by the WAA without sufficient notice being provided to the buyer, either by the owning agency or the WAA, as to their contaminated condition.<sup>99</sup> In this regard, a July 25, 1947 document [see Appendix] noted that:

"Owning agencies have not been too careful about reporting instances of contamination with the result that disposals of land have been made without proper notice to the buyer, and no requirement has been made that the buyer assume responsibility for decontamination."<sup>100</sup>

WAA officials subsequently demanded that the using agency define more precisely and explicitly the extent of contamination prior to transfer of the property to the WAA.

Among the properties blindly transferred to the WAA were bombing ranges and army camps containing firing ranges and proving grounds, all possibly contaminated with "unexploded shells, mines and explosive charges."<sup>101</sup> WAA legal advisors expressed concern that surplus industrial properties used to manufacture explosives and to refine gasoline had been decontaminated only to a "stand-by condition", a condition "short

of total decontamination such as would completely free the property from all hazards."<sup>102</sup> "Stand-by condition," the WAA recognized, did not necessarily require the decontamination of all the lands within the ordnance plant, such as the drainage ditches and the surface area which might be "dusted" with explosive compounds. Nor, it was acknowledged, did stand-by condition mean that the plant itself or its lines could be used for other purposes.<sup>103</sup>

#### Economic Incentives Favored Disposal

Considerable pressure, arising from various factors, was placed on the WAA to quickly dispose of the surplus property in its inventory regardless of its condition. In 1947, the annual protection and maintenance costs for 35 large ordnance plants, with an acquisition cost of over one billion dollars, was approximately \$3,500,000.<sup>104</sup> It was estimated that decontamination and demolition of the plants would cost \$62,000,000. It was small wonder, therefore, that WAA officials referred to the surplus plants as "35 white elephants".<sup>105</sup> High maintenance costs, combined with a seller's market for post-war industrial equipment<sup>106</sup> and the public's desire to quickly convert the plants to a beneficial use, heavily influenced the WAA's disposal policies.

One of the brakes on the uninhibited disposal of contaminated surplus properties was the caution expressed by WAA's legal counsel with regard to the contingent but perpetual liability that might be incurred on the part of the seller, the Federal Government. WAA's counsel advised that contaminated land

could only be sold to the public if full disclosure of the land's condition and restricted use were unambiguously made in a written document.<sup>107</sup> The failure of federal officials to disclose dangerous conditions due to contamination which were known to have existed or could reasonably have been anticipated from the property's prior use and which could not be discovered by the purchaser upon reasonable inspection of the property, would it was feared, lead to liability under the newly enacted Federal Tort Claims Act.<sup>108</sup> As the following passage relates, at least some WAA officials were acutely aware of their responsibilities to an unwitting public:

"Apart from any legal consideration, another aspect merits attention. Upon the occurrence of an explosion or mishap resulting in personal injuries and property damage, it is anticipated that much adverse publicity would attend the incident. Moreover, the public welfare is always a concern of the Government, its agencies and instrumentalities, and in this respect, the WAA has a moral responsibility towards purchasers and those who might be affected by reason of the hazards of contaminated property disposed of without adequate warning or notice of the condition."<sup>109</sup>

An indemnity clause was prepared and apparently used in real estate sales in Louisiana and Mississippi. Therein, the purchaser explicitly acknowledged that the purchased land was contaminated, agreed to assume all costs for decontamination, and to indemnify the Federal Government for any liability from injuries or damages arising out of the land's contaminated condition. The clause also required that all subsequent transferees assume the same liability.<sup>110</sup> There is no indication that this type of clause was required when the contaminated portions of the LOOW were sold by GSA to private buyers in 1966.

## Summary

With regard to the issue of TNT contamination at the LOOW, the Task Force investigation established the following:

- 1) that a portion of the former TNT plant at LOOW, heavily contaminated with TNT residues, was never fully decontaminated by the Army when the property was declared surplus;
- 2) that the federal agency responsible for disposal of the LOOW was aware in 1948 that the plant's surface area and underground waste lines were seriously contaminated and could not safely be disposed to the public prior to the completion of substantial decontamination work;
- 3) that the contaminated portion of the LOOW was utilized by two federal agencies and disposed by a third, GSA, all of whom were apparently oblivious to the site's contaminated condition, despite the documentary evidence of such contamination within the agencies' own files;
- 4) that by some inexcusable lapse in bureaucratic memory, the warnings issued 18 years earlier against public disposal of the LOOW were forgotten and the land conveyed, without notice of its condition, to private owners;
- 5) that post-war disposal policies and economic pressures might have resulted in the sale of contaminated property to other unsuspecting private purchasers.

In light of the above findings, the Task Force has recommended a review of present GSA disposal procedures in order to insure that the sale of contaminated surplus properties, whose condition and prior uses have become masked over the years, is not permitted to recur.

Finally, copies of this Report have been transmitted to the responsible officials in those states in which other former ordnance plants are located. Careful review of those sites is urged.



## FINDING VI

THE USE OF PART OF THE ILL-SUITED LAKE ONTARIO ORDNANCE WORKS BY THE DEPARTMENT OF ENERGY AND ITS PREDECESSORS HAS RESULTED IN SIGNIFICANT RADIOACTIVE CONTAMINATION ON AND OFF THE FEDERALLY-OWNED SITE.

### INTRODUCTION

The pressures attendant to the war effort, and the Government's purchase contract with African Metals Corporation, forced engineers with the Manhattan Project to seek a secure storage facility for radioactive waste from uranium refining operations of the Tonawanda Area (Linde Air Products, Inc., in Tonawanda, and Electrometallurgical Co., Niagara Falls). Although Linde was by no means the nation's primary refinery for uranium ore, it did process a significant quantity of the African ore which started arriving in 1943. Under terms of the Government's contract with Afrimet (African Metals), the Manhattan Project purchased only the uranium in the ore, with the other metals, particularly radium, remaining in the ownership of the vendor. Because the vendor could not take physical possession of the residues immediately after refining, the Government agreed to store the residues securely so all metals would be recoverable at a future date.

Up to 1943, Linde had refined domestic ore mined in Colorado and processed there first for its vanadium content.<sup>1</sup> The residues from this ore were stored without regard to the need for other recoverable metal values, and without the environmental protection required for the radium-bearing African ore.

Accordingly, waste residue from the domestic ore was dumped on the ground at a site in Tonawanda known as the Haist property, owned today by Ashland Oil Co. This storage method being unacceptable for the African ore residues, the Lake Ontario Ordnance Works was designated as the repository for the new materials.

LOOW represented a logical choice for a storage site from a security standpoint. The land was owned and controlled by the military, which reduced the chances of loss of material or pilferage. Moreover, because of military ownership, contamination of buildings and grounds by the radioactive waste would be a problem only for the Government, not for a private landowner or lessor. The concrete water treatment building and the Baker-Smith area were considered suitable places to contain the waste sludge and control the spread of radioactivity. These facilities are located in the southwest section of the LOOW north of Pletcher Road.

From an environmental standpoint, LOOW represented a poor location for storage and dumping of radioactive wastes. As became apparent during construction of the TNT plant [see pp. 182-183 supra], the high water table and heavy annual precipitation created a medium through which radioactive substances and other contaminants could be transported off the Federal property. This feature of the site which should have rendered it unsuitable in 1944 was finally acknowledged in 1955 by the manager of Oak Ridge AEC Operations, S. R. Sapirie, who stated:

"While it is probably true that LOSA\* was originally obtained for the storage of contaminated material, the choice of the site hinged more on availability rather than any unique features making it suitable for such storage....

"The majority of materials at LOSA are stored in bulk or in containers, many of which are now in extremely poor condition and stored in structures which offer little or no protection from the elements."<sup>2</sup>

\*LAKE ONTARIO STORAGE AREA

The wastes code-named L-30 and L-50 were taken to LOOW from the Tonawanda refinery by truck. These were a sludge-type waste, in which radium was in equilibrium with uranium. Although precautions were taken to ensure the trucks would not leak radioactive liquid, some leakage did occur, according to Roy Anderson who at the time was production manager for the Tonawanda Area Office. He told Assembly investigators it was his habit to follow the trucks at some distance in an unmarked vehicle, to make sure leaks were detected, but without causing undue concern to the truck drivers. On a number of occasions, he recalled, leaks from the trucks dripped onto the roadways of Erie and Niagara Counties. However, realizing that there was a considerable hazard from stopping the trucks, and unable to prevent the shipments from taking place, he allowed the trucks to proceed and unload at LOOW. Then he would direct that repairs be made to the gaskets.<sup>3</sup> As for the leaked residue on the roadways, Anderson said, eventually it would "dry up and blow away."

Documentary evidence indicates that the L-30 and L-50 sludges first arrived in early 1944, and were stored in the water treatment building without formal permission from the War Department.<sup>4</sup> However, as was common practice during the war,

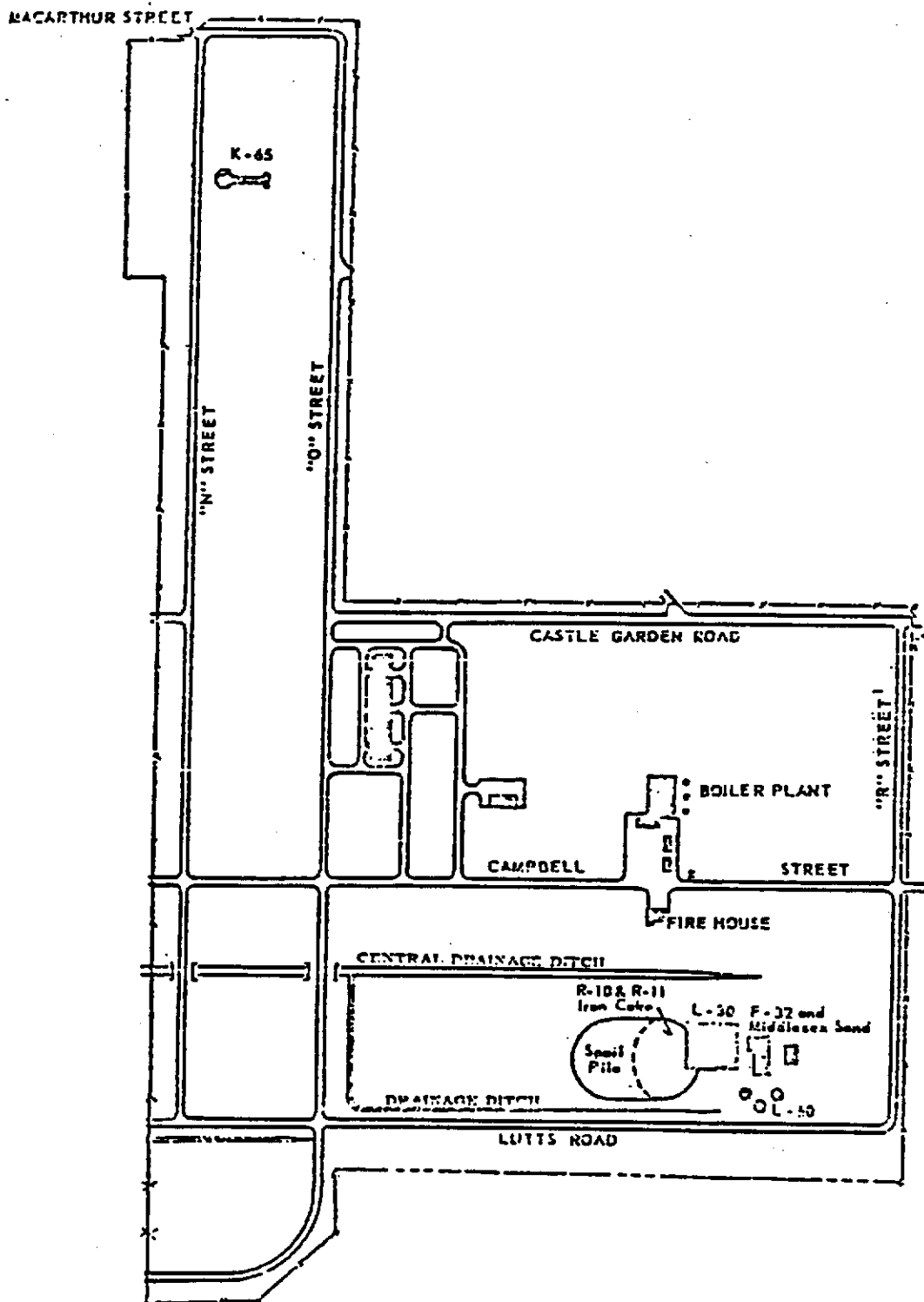
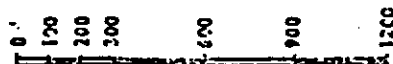
this informal arrangement was given formal approval some weeks after the shipments began. Clearly, the priority given the Manhattan Project during the war allowed the engineers in charge considerable leeway in their industrial activities, so much so that even the storage of radioactive waste could take place in advance of a permit. In all, more than 18,000 tons of waste were brought to LOOW before the end of the war. In addition to other wastes which arrived after the war, all the wartime waste remains on site today.<sup>5</sup>

Table 2.

Inventory of Radioactive Waste which  
Came to LOOW during World War II<sup>6</sup>

<u>Residue</u>	<u>Ownership</u>	<u>Location</u>	<u>Weight (tons)</u>
L-30	African Met.	Bldg. 411	8227
L-50	Afrimet	413-414	1878
R-10	DOE	Outdoors	8325
R-10 Iron Cake	DOE	Outdoors	150

The concrete water tanks used for the storage of L-30 and L-50 proved early on to be inadequate to the task. By 1949, cracks were observed in the tanks, and seepage of uranium residue was analyzed.<sup>7</sup> Residue from the sludge was also traced from the "French drain" beneath the reservoir to the drainage ditch nearby. The surface drainage system has been, over the years, the principal conduit of radioactive contamination to areas outside Federal property. The R-10 pile outside the water treatment building was found in 1949 to be dusting the environment even from a light wind. This condition was not corrected until 1964, when the R-10 pile was covered and seeded.<sup>8</sup>



**FIGURE 11 - Radioactive Waste Storage Locations**  
(Source: Department of Energy 1977)

Erosion by rain and snow of the R-10 pile was also taking place, leaching residue into the drainage system. [See Figure 11]

By the mid-1950s, the situation had improved little if at all. In 1955, Hooker Electrochemical Co. had charge of the site due to its contract with AEC for the production of the isotope Boron 10. A survey of the radioactive materials storage areas at the site by Hooker revealed the contractor's desire that the materials be removed for the sake of safety. Describing the storage operations then, the analyst stated, "the residues are stored in the old Lake Ontario Ordnance Works Area and the buildings and pits of the old TNT facilities have been used. Some of the residues are stored on the ground, some in old concrete tanks of doubtful integrity."<sup>9</sup>

In wartime, the storage of radioactive sludge was accomplished in the most expedient, economical fashion. However, as the later documents reveal, no effort was made after the war to provide for more secure, safer storage.

A. Post-War Storage of Radioactive Waste

As detailed above, the Manhattan Project established the use of LOOW for radioactive waste storage, a function which was perpetuated by its successor agency, the Atomic Energy Commission. AEC was established in 1946, and by Executive Order the functions and operations of the Manhattan Engineer District were transferred to its control at that time, including responsibility for the care of radioactive wastes stored at LOOW.

Although the end of hostilities brought peace to most of the world, the managers of the nation's atomic weapons programs

focused their energies and expertise on the development of an arsenal designed to deter the Soviet Union from certain policies perceived in this country to be expansionist. In the context of growing tension between the U.S. and the Soviet Union, the production of atomic weaponry continued unabated.

One result of this was the expansion of operations at the Lake Ontario Ordnance Works. During the late 1940s and early 1950s, LOOW became a principal depository for radioactive waste from the Eastern U.S., and although some of the waste and contaminated scrap has since been removed to other locations, its effects remain even to the present day. Besides the additional waste which was imported to the site, such as F-32 and K-65, uranium rods and billets were stored temporarily at the site, as LOOW became a holding area for the AEC's rolling operations at Lockport and Lackawana.

Also, after the war the Linde refinery in Tonawanda was decommissioned, and the contaminated portions of the plant were taken to LOOW.<sup>10</sup> Other contaminated metal, concrete, ceramics and lumber from wartime and postwar operations were shipped to LOOW from St. Louis, Mo; Canonsburg, Pa.; Cleveland, Ohio; Deepwater, N.J.; and Winchester, Mass.

The past or present location of contaminated scrap is not completely clear from the documentary record compiled by the Task Force. One inventory taken in 1965 identified an area of metal scrap, glass, graphite, concrete and wood as being located along the south side of the "A" line railroad track.<sup>11</sup> Better documentation exists for locations of radioactive waste products

which have been under long-term surveillance by the AEC and its successors--Energy Research and Development Authority and the Department of Energy.

Although the Government has had continuous responsibility for the integrity of its wastes at LOOW, its efforts at protecting the wastes and the environment have not always succeeded, and radioactive substances have been introduced to the environment. For each of the wastes discussed below, it will be noted that economy and expediency have usually prevailed over environmental protection and common sense caution in the AEC's management practices.

1. F-32 Sludge

Among the first waste to arrive at LOOW was F-32, which originated in Middlesex, New Jersey. Nearly 1,400 barrels of the F-32 were shipped to LOOW pursuant to a directive issued November 23, 1949.<sup>12</sup> The directive, signed by an official of AEC's New York office, prescribed that storage take place in the empty concrete reservoir adjacent to the L-30 tank. Since F-32 was also a sludge and was to be shipped in 1,400 barrels, the tank was thought to provide the best compromise to meet the requirements of medical safety and security at low cost. The 1949 directive also contained detailed instructions pertaining to sealing the tank, patching the concrete, and other measures to prevent leakage of the sludge, which was owned by African Metals Corp. Loss of Afrimet's property obviously would have subjected AEC to damage claims from the company.



However, in spite of the contract's provisions and the potential for damage claims from the owner-vendor, Afrimet, it is not clear that the sludge was in fact stored in the manner which had been designated. Some inventory charts from the period indicate that the tank next to the L-30 tank was in fact the location of the F-32 sludge. But, an inventory of LOOW wastes made in 1965 reported that the F-32 was stored "in an outside pit".<sup>13</sup> Today the sludge is housed in Building 410, a former water filtering facility.<sup>14</sup> [See Figure 11]

The actual ownership of the F-32 sludge was in doubt for some time, perhaps as a result of the same inattentive record-keeping by the Atomic Energy Commission. The AEC's contract with Afrimet provided that if the vendor did not take possession of the sludge before June 30, 1959, the sludge would become property of the U.S. Government.<sup>15</sup> Although the change in ownership was to have taken place automatically in the absence of action by either AEC or Afrimet, by 1965 there was still question at AEC as to who owned the F-32 sludge. The 1965 inventory cited above listed ownership as "?" which may be more an indication of AEC's lax internal record maintenance than of its possible failure to enforce the ownership transfer provision of its contract with Afrimet.

The potential hazard presented by the F-32 sludge is indicated by its radium content, 57 mg per ton, or a total of 12 grams in the 435,000 pounds of sludge.<sup>16</sup> This concentration was reported to be about twice that of the adjacent L-30 waste, and about one tenth that of the K-65 waste which was then being

shipped to the LOOW site. The location of the storage site of F-32 was near the Central Drainage Ditch, a factor which undoubtedly contributed to the contamination of the ditch<sup>17</sup> (due to the unfavorable drainage patterns at LOOW) and to the subsequent migration of radioactive contamination to areas outside Federal property, as discussed below in pp. 244-254 infra.

## 2. K-65 Sludge

The waste type at LOOW which contains the highest concentration of radium, and which has caused the most concern over the years, is K-65, a sludge residue from African ore refined at Mallinckrodt Chemical Works, St. Louis, Mo. With a radium concentration ten times greater than the F-32 sludge, and twenty times the level of L-30, transportation and storage of K-65 presented much greater hazards for workers and operators alike at LOOW. The need for a storage program for K-65 arose somewhat unexpectedly for the AEC, when Afrimet notified the commission in early 1949 that it would no longer accept possession of the residue, but instead wanted it stored for possible future use. Therefore, in order to keep its St. Louis refinery operating at full capacity, the AEC had to find a place to store the residue which accumulated daily from the refinery's operations. Yet underlying the various stages of the K-65 storage program was a pattern of unplanned and sometimes haphazard activities, and an apparant absence of forethought as to the overall suitability of the LOOW site for long term storage of such waste.

### Transport of K-65 to LOOW

Although the shipments of K-65 in 1949 routinely incurred damage en route from St. Louis due to inadequate strapping of the drums, the AEC sought in August to both reduce its shipping costs and, possibly, circumvent railroad safety provisions, by changing the description of the shipments from "ores" to "silica." It is not entirely clear from available documents what was meant by this change in description. It is probable that "silica" could be treated as a less hazardous material than "ores," requiring fewer safeguards enroute to its destination. The effect, in any case, was to lower shipping rates from \$14.55 per gross ton to \$10.37 per gross ton, a savings to AEC of about \$7,000 per year in shipping costs. The change was made at the request of the New York Operations Office of AEC to the Association of American Railroads, and was reported in a weekly report of NYOO of August 17, 1949.<sup>18</sup>

### Igloo Storage of K-65

The first shipments of K-65 to arrive at LOOW were delivered to one of the concrete igloos north of Balmer Road, a procedure which was quickly abandoned once radiation measurements were taken.<sup>19</sup> A cursory internal AEC study had indicated the igloos would provide long term storage capacity, and would enable AEC to store the sludge without removing it from the drums first.<sup>20</sup> But radiation measurements inside the igloo after the first day's operation were so high that the project was re-evaluated. At the end of the first day, 96 drums had been placed in igloo #9050, and radon levels were:

"29 times tolerance. Loading operations were resumed on the following day at which time when Igloo #9050 was re-entered,<sup>21</sup> the concentration was 71 times tolerance."<sup>21</sup> [See Appendix]

The radon levels emitted by the drums of K-65 were further indicated by the precautions taken in unloading the drums from the railcars at the igloo. The stipulated procedure called for one worker operating a hand lift inside the car to bring the drums to the doorway, where another worker used a fork lift to take the drums off the car and place them inside the igloo. The procedure called for the worker inside the car to leave the car between loads so as to reduce his exposure to radon accumulating within the enclosure.<sup>22</sup>

Abandonment of the igloos as a repository for K-65 did not halt the shipments from St. Louis. In fact, K-65 was arriving at LOOW in quantities "far exceeding" the site operators' estimates at the time,<sup>23</sup> and pressure mounted for establishment of a permanent handling and storage facility. While engineers investigated the suitability of the concrete water silo, constructed originally for holding cooling water for the TNT plant, the drums continued to arrive at the site, and were left out in the open, along roadways and railroad sidings.<sup>24</sup>

#### Water Silo Storage of K-65

The next designated repository for K-65 sludge was the concrete water tower which had originally been built with the TNT facility to contain cooling water. However, in order to use the silo, engineers had to solve a number of problems. First, a determination had to be made as to the strength of the tower to contain the waste. Second, the subsoil beneath the tower had to

be tested to determine whether the tower would settle unevenly with the added weight. Third, since the waste was to be stored in bulk, rather than in drums, a mechanized unloading device would need to be designed and built so the drums could be dumped into the silo with a minimum of radioactive exposure to workers. Finally, all this had to be accomplished within apparently very stringent cost constraints.

Engineers' analysis of the tower's strength led to the preparation of specifications to reinforce the structure. The work included steel and concrete reinforcement of the tubular base of the tower, and design and construction of an elevated tank base within the tower to maintain the K-65 above ground level.<sup>25</sup>

Soil tests indicated only that the tower could settle unevenly if it was loaded asymmetrically, so precautions were taken to avoid that.<sup>26</sup> Otherwise, the clay base was expected to maintain the tower without compaction.

Once the reinforcement work was completed for the tower's top and bottom sections, load limits of 1,190 and 2,500 tons respectively were set for each section, based on the estimated strength of the tower and its foundations to bear the load.<sup>27</sup> Capacity limits became a critical factor for the LOOW environment during the silo loading period, because AEC was unable to load the silo as fast as the waste arrived. Consequently, thousands of barrels remained along roadsides, exposed to rain and snow, for months before they were opened and their contents dumped into the silo. In April 1951, AEC decided to resurvey the tower to

see if the load limits could be increased.<sup>28</sup> The increased limits were conditionally approved in September 1951,<sup>29</sup> but cracks began to develop in the tower and dumping was suspended, leaving 4,500 drums, full of sludge and emitting radiation, along the roadsides and ditches of LOOW. Some of the drums had been stored outside so long that they were "in such a condition of deterioration that they must be redrummed before they are dumped."<sup>30</sup> When a representative of African Metals visited the site to inspect the tower, he was shown the cracks and told of the September 1951 approval given by African Metals' subcontractor to raise the load limits. Afrimet did not accept the subcontractor's approval, and in fact vetoed the continued overloading of the silo.

There is no indication in documents that AEC was not moving as quickly as it could to securely store the K-65. But the sludge arrived faster than it could be dumped, and by August 1952, more than 5,000 drums were stacked along roadsides awaiting final storage, and up to 1,500 of them were so badly deteriorated they needed to be redrummed.<sup>31</sup> The drums were leaking radiation into the air and the drainage system, a situation first observed in 1950, when the drums had been there only a few months. The surveyors then noted "the K-65 which is stored in drums along roadways and in an open area about 600 feet east of the office building is the greatest source of radon. Highest radon concentrations occur a few feet downwind from the greatest concentrations of K-65".<sup>32</sup> This hazardous situation was allowed to persist for two years before the drums were loaded back onto railroad cars for final shipment to AEC's plant in Fernald, Ohio.

As will be seen in a later discussion, the K-65 was a significant early contributor to radioactive contamination, both on and off the LOOW site. The storage operations were unplanned and haphazard, and the silo itself proved to be structurally inadequate. Although overloading was halted in 1952, the silo was still under considerable stress and required remedial work by 1960.<sup>33</sup> At that time, only eight years after the loading ceased, the silo was described as "in a very poor state of repair. The surface of the silo, which is concrete, is spalling very badly in places, and wire reinforcing which appears to be pre-stressed has deteriorated and in places is hanging down the side of the silo...It was learned at the time that no past or future maintenance was scheduled".<sup>34</sup> The question of the silo's later condition and original capability to hold the sludge will also be discussed in a subsequent section. [See pp. 262-266 infra.]

### 3. Knolls Atomic Power Laboratory Waste

Perhaps the most perplexing of the waste residues to be found at LOOW originated at Knolls Atomic Power Laboratory in Schenectady, a long time MED-AEC facility operated through General Electric Co. The KAPL wastes are distinguished from other wastes and contaminated scrap at LOOW in that they included fission products--radioactive isotopes resulting from fission reactions--whereas the other waste discussed herein consisted of refining residues. A second distinguishing characteristic of the KAPL waste is the almost complete absence of primary records showing how much was shipped, where it was kept and what its radioactivity was. Such records as do exist are comprised of

routine weekly reports of activities at the site with references to the KAPL shipments, charts and maps indicating known locations of KAPL products and other such secondary references. This dearth of primary records is possibly indicative of the extraordinary security associated with the KAPL program. If so, such security has seriously handicapped even DOE analysts in determining the extent of the hazard posed by the residues of the KAPL waste which still exist at the site.

The presence at LOOW of residual fission products, particularly Cesium 137, presents a grave contradiction for the U.S. Government. On the one hand, fission products, which are extremely dangerous and volatile, have normally been quite closely controlled by DOE and its predecessor agencies, including AEC. On the other hand, the dearth of records about such important substances at LOOW would indicate that the super security system may actually have masked either a cavalier attitude about the materials or gross bureaucratic incompetence on the part of KAPL or AEC personnel. This possibility can not be lightly regarded in view of the fact that in 1971, during an AEC survey of contamination outside Federal land, a senior AEC official was unable to fully account for the presence of Cesium 137 based on available records.<sup>35</sup>

The area containing Cesium 137 was described in 1971:

"Three localized spots of contamination ranging from 1-60 mr./hr were found in the area of old burned buildings. Surface drainage from the area had apparently contaminated a stretch of drainage ditch east of the area to a level of up to 2 mr/hr for 200-300 ft. This area reportedly housed old KAPL waste at one time, but the waste was reportedly removed from the site."<sup>36</sup>



The lack of records available to the analyst prevented him from being more accurate as to the origin and removal of the materials. The lack of records on this waste seems to have been characteristic, though, from the beginning. Upon its arrival at LOOW, the KAPL materials were described only as "combustibles and noncombustibles"<sup>37</sup> and processing wastes stored in 55-gallon drums.<sup>38</sup> The processing wastes are now believed to include plutonium and fission products "from the evaporator bottoms of the low-level processing plant at Schenectady."<sup>39</sup>

The KAPL waste storage program followed a pattern similar to the unplanned K-65 program. At first, the KAPL waste was stored near a railroad spur just north of the present DOE site on land now occupied by SCA.<sup>40</sup> The waste began to arrive in October 1952,<sup>41</sup> and the building first used to house it was located about thirty feet north of "M" Street.<sup>42</sup> [See Figure 12]

Handling and storage practices for the KAPL waste were equally haphazard as for the K-65. The waste was supposed to be stored so that combustible and noncombustible waste would be segregated, and this was accomplished in the initial storage facility near the railroad spur.<sup>43</sup> But when AEC decided to release a thousand acres from its control, and to build a manufacturing facility for Boron 10, the drums and crates from Schenectady were moved to a site on the western boundary of LOOW near the Baker-Smith area. After relocation, the materials were no longer segregated, the shed in which they were stored was described as "combustible", and the location was beyond the range of the nearest fire hydrant. KAPL officials at first tried to

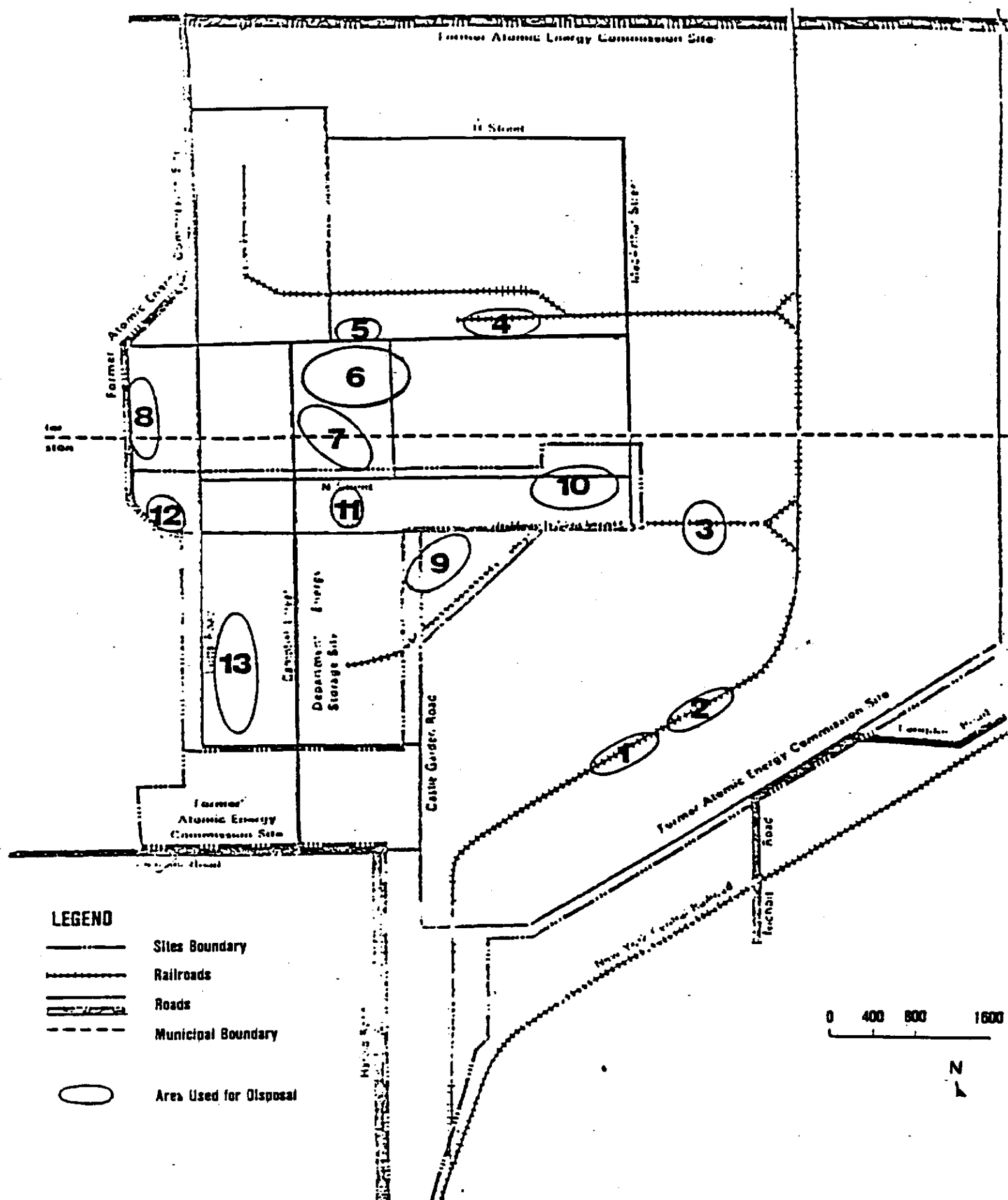


FIGURE 12 - Disposal Sites at the Former AEC Site  
(Source: Department of Energy 1980)

## FIGURE 12

### LEGEND

1. and 2. -- Scrap Metal Disposal Area.
3. Scrap Metal Disposal Area, radioactivity up to 6 milliroentgens per hour.
4. Burial Ground North of "M" Street and First Storage Area of KAPL Waste.
5. Rubbish Area North of "M" Street.
6. Castle Garden Dump.
7. Rochester Burial Area.
8. Sewage Treatment Area near Western AEC Boundary.
9. Titanium Residue Burial Area.
10. K-65 Storage Area.
11. Dump of Scrap and Waste from Navy-Mathieson Area.
12. Second Storage Area for KAPL Waste (Highest concentration of Cesium 137 is in this area).
13. Baker-Smith and Water Treatment Area (L-30, L-50, F-32 and R-10).

pass off responsibility for the care of the wastes to AEC, but site officials maintained that KAPL was still responsible.<sup>44</sup> AEC complained internally that the wastes were being stored in inappropriate structures, namely "construction contractor warehouses and shop buildings," which had received no maintenance since 1943.<sup>45</sup> Particular concern was expressed for the plutonium and fission products stored in a building which was both a fire hazard and so deteriorated that it offered no protection from the elements.<sup>46</sup>

The survey report of January 15, 1971 identified an area near the sewage treatment facility as having once stored old KAPL waste. [See Figure 13] The survey also reported heavy concentrations of Cesium 137, a fission product, in the same area. Evidence that the handling and storage of Cesium 137 left residues behind was reconfirmed in 1980 by Battelle Memorial Institute of Columbus, Ohio. That survey again found significant concentrations of the substance in most of the surrounding drainage systems as well as near the sewage treatment area.

According to various reports, the KAPL wastes were eventually shipped to Oak Ridge, Tennessee, and some of the remains were burned by the site custodian, Hooker Electrochemical Company, in the late 1950's.

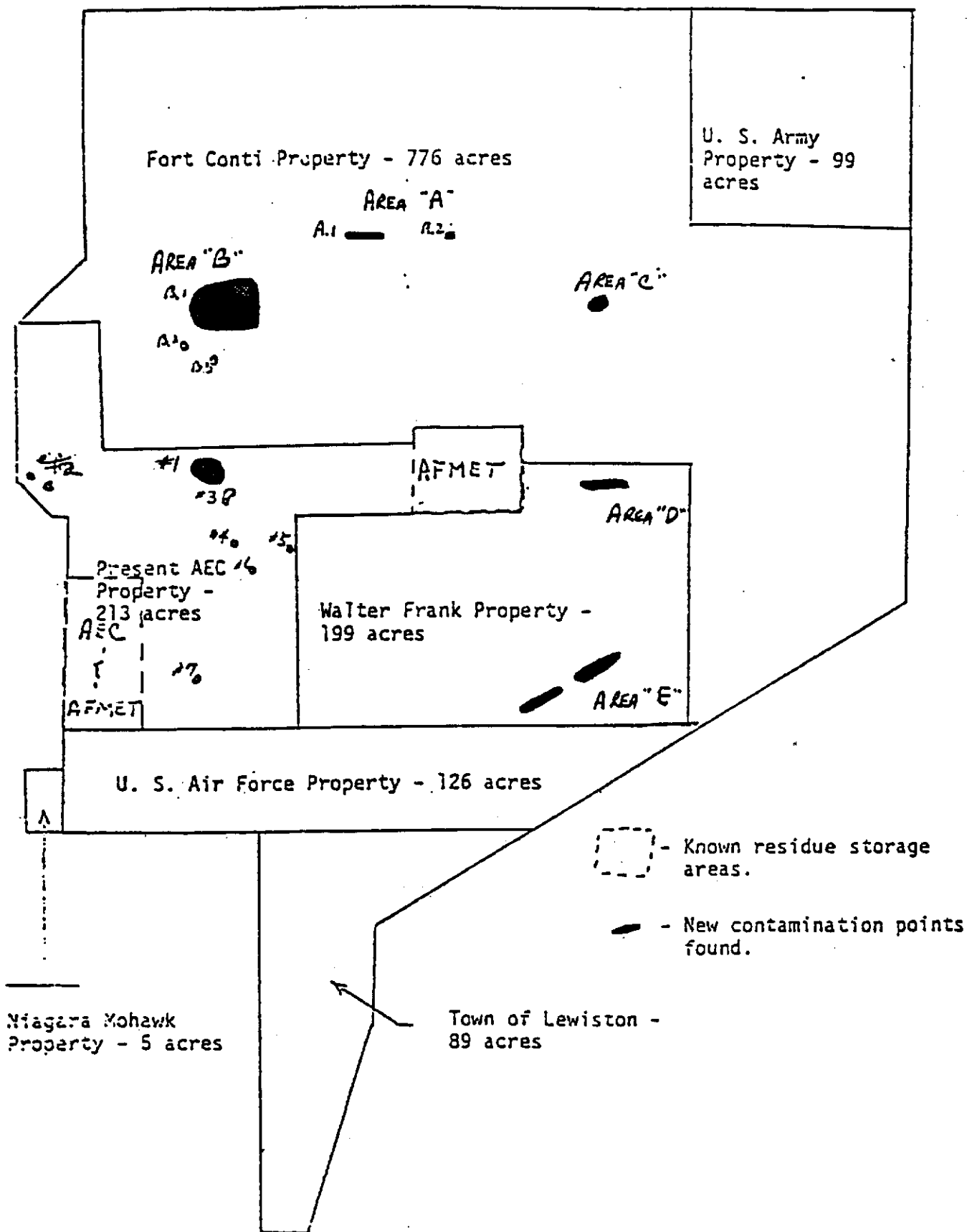


FIGURE 13 - Plot Plan of Original 1,511 Acre AEC Lake Ontario Site  
(Source: AEC 1971)

## FIGURE 13

### LEGEND

Area "A" -- First KAPL waste storage and scrap burial area, same as Location 4, Figure 12.

Area "B" -- Castle Garden Dump and University of Rochester Burial Area, same as Location 6 and 7, Figure 12.

Area "C" -- Reported Old Dumping Ground

Area "D" -- Scrap Disposal Area, same as Location 3, Figure 12.

Area "E" -- Scrap Disposal Area, same as Locations 1 and 2, Figure 12.

#1. Dump of Scrap and Waste from Navy-Mathieson Area.

#2. Second Storage Area of KAPL Waste.

#3-#7. Localized Areas of Contamination.

#### 4. Other Dumps of Radioactive Materials

Many other radioactively contaminated materials were dumped at LOOW up to 1954. These include building materials from the AEC's dismantled factories in St. Louis and Tonawanda, animal carcasses and equipment from the University of Rochester, scrap metal and other miscellaneous items. Locations of these materials and residues are described in various AEC/DOE documents.<sup>47</sup> [See Figure 14]

Two areas in particular, the Castle Garden Dump and the Rochester burial area have been identified in several radiological surveys over the years.<sup>48</sup> The Castle Garden area once contained contaminated metal scrap (about 400 tons) "which was sent to this area for storage because it was too 'hot' at that time for disposal to outside channels; or the metal was of a non-ferrous nature for which disposal was not authorized to commercial sources at that time."<sup>49</sup>

The Castle Garden Dump is located west of Castle Garden Road just south of "M" Street. The Rochester Burial area containing the animal carcasses is just south of the Castle Garden area. Both locations are on land now devoted to chemical waste lagoons, owned by Service Corporation of America (SCA).<sup>50</sup>

None of the studies taken to date have ruled out the possibility that there may be burial areas which have not been identified; radiation readings have led surveyors to disposal sites for which no records exist.<sup>51</sup> When they have been unable to determine the source of radioactivity at a particular location, officials have marked it on a chart and awaited the

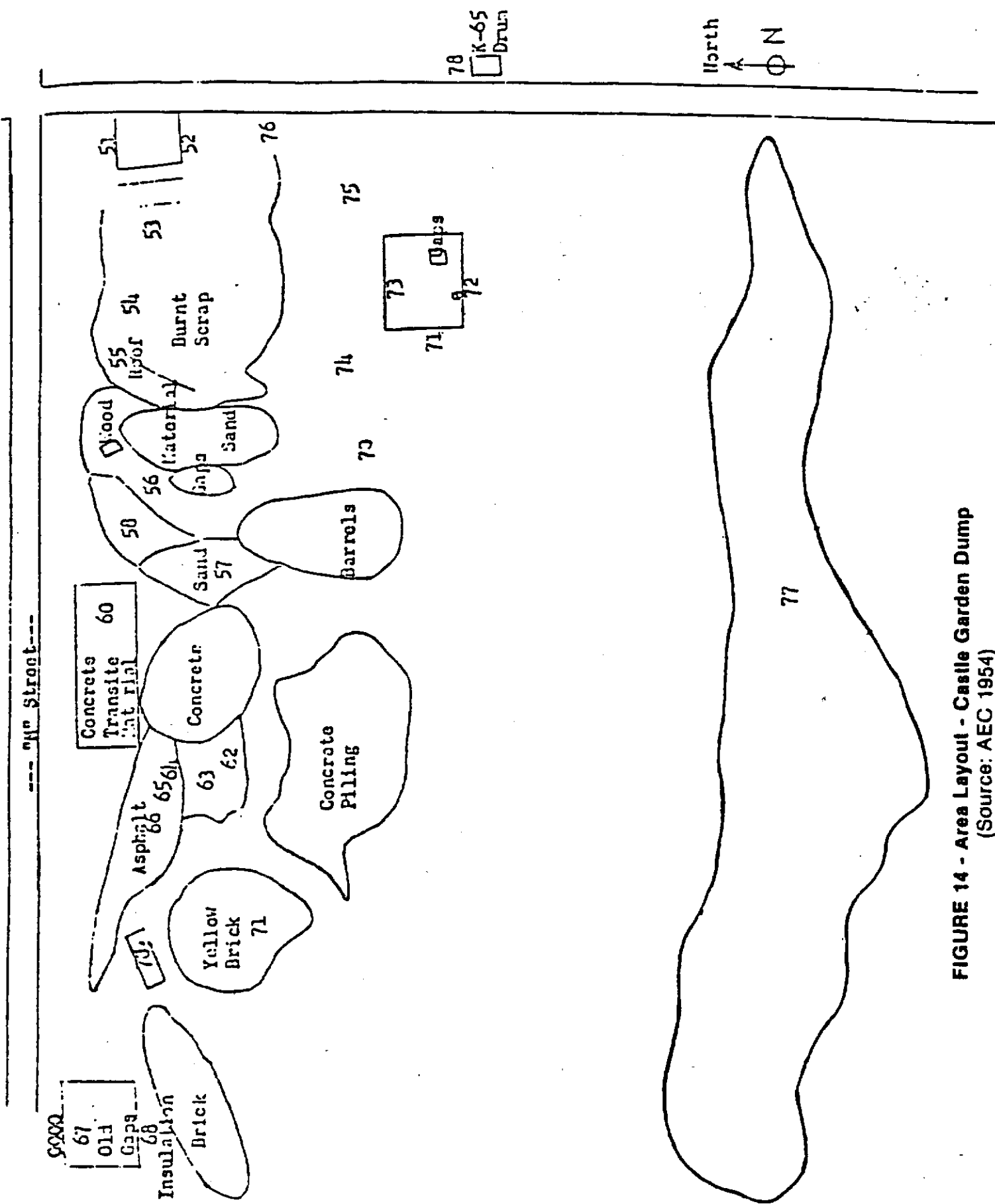


FIGURE 14 - Area Layout - Castle Garden Dump  
(Source: AEC 1954)



development of decontamination plans. As an example of the efficiency of this procedure, the 1970-71 survey identified several areas outside Federal property which had radioactive contamination, and in 1972, they were supposedly attended to as part of a general decontamination program. But, according to the August 1980 report, these areas are still contaminated, and other, previously unidentified, areas have been added to the list of contaminated lands outside Federal property.<sup>52</sup>

B. Disposal of Non-Radioactive Hazardous Waste

Not all of the waste generated by AEC operations was radioactive. Some came from metal refining processes which generated non-radioactive, but nonetheless hazardous, waste. Two examples of how such waste was disposed of at LOOW concern excess ferric sulfate from Linde during 1949, and zirconium refining residues which created spectacular explosions when buried at LOOW in 1953.

In 1949, Linde, still an AEC contractor, requested authority to dispose of about 24,000 pounds of ferric sulfate. AEC estimated that the cost of advertising and preparing the material for sale would exceed its sale value, and so the chief of the Tonawanda sub-office was told to "dispose of this material by dumping and abandoning in some area" at LOOW.<sup>53</sup>

Zirconium residue from refining at Titanium Alloys Manufacturing Co. presented a more spectacular example of waste disposal. After the residue was removed from a TAM warehouse at LOOW, it was dumped into pits [see Figure 12 location 9] and covered. According to a report at the time:

"Immediately after covering this material sporadic explosions of the buried drums occurred. Following the explosion patches of fire and steam arose from the ground. In several instances the fire was intense enough to sear small sections of the warehouse close by."<sup>54</sup> [See Appendix]

The explosions continued for several days, then abated, but the waste is still considered by DOE to be pyrophoric.

DOE has listed this burial as one requiring remedial action because it is located on land which has been sold to private owners.

#### Security Problems at LOOW, 1950-1953

During the early 1950s, LOOW was a principal trans-shipment facility, with shipments of materials going in and out, radioactive waste arriving, being stored, buried, relocated and removed again. In March 1953, an attempted theft of "nickel trays" took place, and the investigation of the attempt revealed a number of areas where accountability and internal control were lax.

The incident itself began when a security guard accidentally discovered a car stopped on Balmer Road at 2:30 a.m. one night. The car drove off, and the guard found a quantity of nickel trays in the ditch by the road. All AEC employees at the site were questioned about their activities, but no charges were filed against any of them. However, the interviews led investigators to recommend various administrative and personnel changes to ensure better internal control of scrap inventories.<sup>55</sup>

Notable among the problems identified was an almost routine practice whereby the foreman permitted other workers to use an AEC truck to transport "rock slag" from the site to their homes,

for driveway paving, clean fill, etc. The practice was so common that one worker's wife was asked by an acquaintance in Youngstown if her husband was "getting in on the gravy in LOSA (Lake Ontario Storage Area). I asked my wife what they meant and she told me that it was in reference to the use of a Govt. truck in transporting slag from the Area to other personnel of LOSA's homes."56

It is obvious from the investigatory file that AEC officials certainly did not condone such practices. However, the attempt was discovered only by accident, not because accountability procedures were particularly tight. In the context of the site's activities at the time, and the haphazard nature of storage and burial operations, it is to be expected that workers in charge of scrap supplies would adopt an attitude toward such materials which replicated that of the officials in charge.

What is not known about the lax security at LOOW is whether it resulted in the inadvertant transport of radioactively contaminated material. The recent identification of radioactivity in paving materials at various sites in Niagara County could indicate that C-slag, brought to LOOW from Electromet operations in Niagara Falls, was later transported off the site by unauthorized personnel employed by AEC.

#### C. Migration of Radioactivity

Over the years, high rates of annual rain and snowfall, a high water table, impermeable clay soil and poor surface drainage have combined with sloppy storage practices to cause contamination of lands outside the Federal Government's control.

The groundwater characteristics of the site were known, however, before radioactive waste first was stored at LOOW, and the subsequent problems in controlling the spread of radioactivity should have come as no surprise to the site's managers. A brief review of the progress reports from the construction of the original TNT plant during the winter of 1942-43 would have given them a picture of the environmental impediments to the secure storage of radioactive materials. [see supra pp. 182-183]

But even after knowing that the immutable facts of nature were working against them, officials in charge continued to expand the amounts of radioactive materials stored and dumped at the site.

Periodically, after the storage of radioactive materials began in 1944, the AEC conducted radiological surveys of the site to determine whether contaminants were in fact migrating about the site. In each such survey examined by the Task Force, 1947, 1949, 1953, contamination was either anticipated (1949) or was found to be significantly above background levels, especially in the drainage ditches and swamps. However, the observation of such contamination did not prompt officials to take remedial action, nor did it cause them to abate their storage operations until the mid-1950s.

1. Survey of November 3, 1947

Chronologically, the earliest survey found by the Task Force was taken during 1947 at both the LOOW and the Haist Property in Tonawanda.<sup>57</sup> At that time at LOOW, the storage operation was limited to the wartime waste--L-30, L-50 and R-10--all of which

was in the Baker-Smith Area in the southwestern part of the site. Soil, water and air samples were taken at several locations, both inside the storage buildings, and outside in the environment. In those days, soil concentrations were expressed in grams per gram (g/g), and also as a multiple of the "expected amount" a term which is roughly equivalent to today's expression of "background" or naturally occurring radiation. Established "expected amounts" of radium, for instance, were  $10^{-13}$  g/g.

Three samples taken in the survey were indicative of the significant contamination being caused in 1947 by the storage of radioactive waste.<sup>58</sup>

"Sample No.	Location	Analysis	Multiple of expected amount
1	Drainage ditch E of large storage vat building	Ra $4.1 \times 10^{-9}$ g/g	41,000
8	Baker-Smith E Warehouse, E side inside	Ra $7.3 \times 10^{-8}$ g/g	730,000
12	Drainage ditch at NE corner of Manhattan Area	Ra $4.7 \times 10^{-10}$ g/g	4,700"

Radium concentrations, especially in the ditches, were several orders of magnitude greater than background levels, and AEC had its first clue as to what effect its storage operations were having on the environment. Air samples taken inside the storage buildings were likewise several times the level described as "tolerance."

What effect this survey had on the AEC is difficult to tell from the documentary evidence. However, in early 1948, officials

at AEC headquarters seem to have become concerned about the environmental impact their operations might be having.

## 2. AEC Environmental Policy

On February 9, 1948, a memorandum was circulated to all AEC Area Managers in the country from the commission's chief sanitary engineer.

The Policy paper called attention to the growing problem of disposal of toxic and radioactive waste at AEC plants, and urged a new program involving other Federal agencies to control the environmental impact of such waste. The paper discussed the inadequate knowledge of how waste may have travelled through the ground or waterways, and what effect it may have had on the commission's neighbors. The memo shows remarkable insight into the relationship of AEC to its surrounding civilian communities, and into the ultimate questions of safety and public health which its operations posed.

A.E. Gorman, Sanitary Engineer, declared,

"in order to meet its (AEC's) responsibilities to those affected as well as to safeguard its own interest, especially for future expansion, extensive background information is needed on basic environmental conditions in and surrounding existing and future areas of operation. This is particularly true in matters affected by weather conditions, the characteristics of surface soils, vegetation, water, and the geology of subsoils and underground water sources." 59

Gorman's description of AEC's responsibility to its workers and the public was quite eloquent. He asked if tolerance and safety standards were conservative enough to ensure adequate protection of public health, especially since they were determined without the use of actual human exposure data.

"Tolerance standards and factors of safety used--conservative as they may seem to many of our experts in nuclear physics and chemistry--usually were not arrived at on the basis of actual human exposure and experience. Are we sure, therefore, they are adequate? Are we meeting in full our responsibilities? It is unthinkable that A.E.C. would permit the discharge of long-life radioactive or toxic wastes into the ground or to waterways without ascertaining, within reasonable limits, what effect these actions will have."<sup>60</sup>

Gorman criticized the dearth of data on waste disposal practices and called for the collection of more complete information before expansion plans at any facility were implemented.

"In considering locations of new atomic energy plants and expansion of existing facilities, factors of meteorology,<sup>61</sup> hydrology and geology are of prime importance."

This is noteworthy because of the pressure which was building at the time to increase waste disposal and storage operations at LOOW.

Gorman proposed a program utilizing experts from the Geological Survey (Department of the Interior), the Weather Bureau and the Public Health Service to analyze, respectively, ground water and surface water supplies, weather forecasting, and potential stream pollution affecting AEC operations.

"If our problems of water supply, waste disposal, and environmental hazards were attacked by balanced teams of experts from these Federal agencies, working with qualified experts in AEC in Washington and in the various areas of operation and with the staffs of its contractors on specific assignments as a part of an overall program, much could be accomplished which is essential to the national welfare and security."<sup>62</sup>

Although Gorman's paper was issued prior to the importation of F-32, K-65 and KAPL wastes, among others, the 1947 survey had

already confirmed significant contamination from the L-30, L-50 and R-10 waste. As a result of the spreading contamination, the War Assets Administration, technically the AEC's landlord at the time, offered to transfer the entire area of the site south of Balmer Road to the AEC. WAA reasoned correctly that it would be unable to dispose of the land to anyone else once it was contaminated from AEC residues. Moreover, the AEC itself declared its holdings to be "contaminated to such a degree that it is impractical and uneconomical because of a potential health hazard to decontaminate and restore to its original condition."<sup>63</sup>

3. U.S.G.S. Report of March 1, 1949

Gorman's concern may have been too late to stop the permanent contamination of the Baker-Smith area, but the program he outlined appears to have been put into effect. By June 1948 a team of geologists from the U.S. Geological Survey investigated LOOW, looked at its geology and hydrology, analyzed its drainage patterns, and sampled soil and water both on the site and outside the Federal boundary.<sup>64</sup> The test was conducted because of the possibility that radioactive liquids (or radioactively contaminated surface runoff) could percolate to the water table and then spread horizontally to contaminate surrounding domestic wells. Previously this had been thought improbable. As the geologists themselves said,

"it was originally thought that the radioactive liquids would seep into the ground, and by gradual dispersion and finally by fixation (absorption or adsorption) to the soil particles and ultimate decay of radioactivity would be rendered harmless."<sup>65</sup>



The study found, however, that the clay overburden was of such thickness that migration of contamination through it would be unlikely. Even so, the surface drainage system was identified as a potential conduit of contamination, since the central drainage ditch was less than 100 feet from the buildings and grounds where the waste had been dumped.

In their investigation, the geologists established test wells at more than 30 locations in and around the LOOW site to analyze whether radioactively contaminated liquid was percolating into the groundwater from the clay surface soil. Soil samples indicated that the clay was of such low permeability that it was

"unlikely that any radioactive liquids seeping into the ground...would penetrate rapidly to the bedrock. This, coupled with the low permeability of the bedrock itself, and the fact that the nearest drilled wells in bedrock are more than a mile away, makes it extremely unlikely that these wells would become contaminated. The extent and character of the (clay) overburden also make it unlikely that even the nearest dug wells, which on the down gradient side are more than 1 mile away, would become contaminated."<sup>66</sup>

In spite of these favorable assessments, the geologists warned that the surface drainage system was potentially the greatest contributor to contamination of non-Federal Lands. "It is entirely possible, therefore, that it (the central drainage ditch) also receives seepage directly from the disposal area. This is a factor which should be determined."<sup>67</sup> The consequences of this drainage pattern were an environmental threat to Fourmile Creek and to Lake Ontario, because, "if radioactive liquids entered the ditch at the disposal area, they would be carried directly into Fourmile Creek and on to Lake Ontario."<sup>68</sup> The geologists concern was heightened because several local farmers

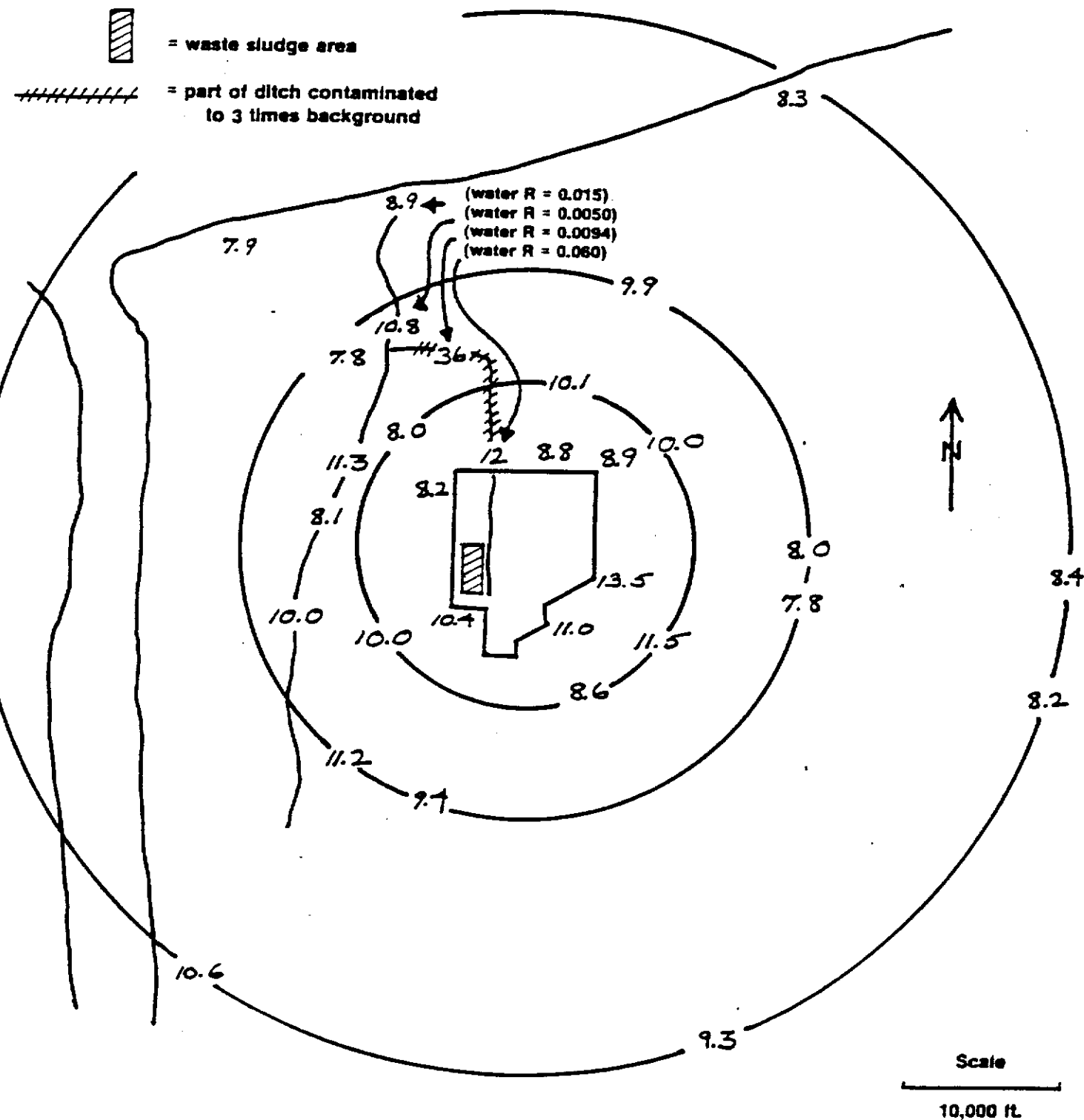
used the creek to water their cattle and, farther downstream the stream was used to irrigate a golf course. The Task Force has found no evidence that local cattle or their milk were ever analyzed to determine if radioactive contamination had been spread through the stream.

The report recommended periodic sampling of test wells around the site as a way of determining if contamination was spreading through the groundwater. Sampling of Fourmile Creek downstream from its confluence with the Central Drainage Ditch was also urged.

Although cautious in its wording, the report was prophetic in terms of the future impact of the dumping and storage of radioactive materials. Later the same year, 1949, waste began arriving from St. Louis (K-65) and New Jersey (F-32). Contaminated equipment and building material came from St. Louis and Tonawanda. The rain and snow continued, and the contamination of the surface drainage system was unabated.<sup>69</sup>

4. 1953 U.S.G.S. Survey Shows Contamination Outside Federal Land

A second U.S.G.S. report, prepared at the request of Gorman in 1952, was published in early 1953, and it showed clearly that radioactivity had spread outside Federal property.<sup>70</sup> Samples of water collected from the Central Drainage Ditch north of AEC's boundary showed concentrations of uranium and radium up to three times background level. [See Figure 15] Although the report did not recommend against future burial of "contaminated scrap", it did caution that if such burial was to take place, more radiological monitoring would be necessary.



**FIGURE 15 - L.O.O.W. and Four Mile Creek soil and mud radium, (g/g)  $\times 10^{13}$**   
(Source: U.S. Geological Survey 1953)

The overall poor drainage situation at the site was the geologists' principal concern. They noted that the flow of Fourmile Creek and other streams in the area was fed by seepage of groundwater in part, especially during periods of no rain. And although none of the streams was a source of municipal or domestic water, they were used to water cattle. The only means by which radioactivity was thought capable of migrating off site was through groundwater movement. This was predicted only for times when the water table rose above the elevation of the creek beds, at which time a large fraction of the ground water would discharge into the creek or ditch.

The report presented data on seasonal water table fluctuation which showed the table as high as two feet below surface in the springtime, declining to only nine feet below in the fall. By 1953, burials of scrap and other contaminants had already been made to depths of six feet, including some KAPL waste,<sup>71</sup> easily intersecting the water table for extended periods of time.

Allowing for the possibility that isotopes would be adsorbed by soil particles, and contamination thus diluted, the geologists were optimistic that any radioactivity would be virtually harmless by the time it was diluted in the waters of Lake Ontario.

They did, however, acknowledge that alpha activity in bed material of Fourmile Creek could be of "possible significance."<sup>72</sup> Samples from late 1949 submitted as an appendix to the 1953 report showed uranium and radium activity up to three times

background level in the ditch. Increased monitoring of the creek and drainage system was recommended in order to avert further contamination.

Unknown to the geologists, it was reported, was the influence of the potential adsorption of radioactivity by earth particles, and also the nature of the materials proposed to be buried then at LOOW. But despite these "unknowns," they recommended extensive increased monitoring of water and soil throughout the area, particularly:

1. Test wells near the Water Treatment Area (site of L-30, L-50, F-32 and R-10 areas) for continuous monitoring of possible contamination.
2. Periodic sampling of ditch and creek water, public water supplies and nearby farm and domestic wells.
3. Soil sampling by borings to check for contamination.<sup>73</sup>

The report punctuated the era of radioactive contamination which was to end shortly afterwards. The K-65 tower was filled and the remaining undumped barrels shipped to Fernald. KAPL waste was removed to Oak Ridge, and other potential contaminants were stored elsewhere in the country. More important, AEC developed plans for the construction of a factory at LOOW to produce the isotope Boron 10, a non-radioactive element. Hooker Electrochemical Company was given the contract to operate the plant and generally to be the caretaker of the LOOW site. As part of its duties, Hooker undertook a cleanup of the site, consolidating various scrap piles, radioactive burials and wastes on the AEC property.<sup>74</sup>

5. Hooker Electrochemical Co. Cleanup at LOOW -1954

The Hooker cleanup represented the first attempt by AEC to consolidate the contamination at LOOW to make room for other uses of the site. The cleanup was precipitated not only by construction of the Boron 10 facility, but by plans of the Navy and Mathieson Chemical Co. for a fuel fabricating plant.<sup>75</sup> Contaminated dumps and burials were charted, measured and indicated on maps.<sup>76</sup> The first cleanup efforts were made in the late fall and early spring of 1954-55. Afterwards the areas were checked again for radiation. Since they were then considered still too "hot" to release to the Navy, more remedial work was done by the summer of 1955.<sup>77</sup> The areas of concern included: 1) the Castle Garden Dump; 2) various scrap piles, some of which contained quantities of "cesium gaps"; 3) the original KAPL waste site near "M" Street; and 4) the Rochester Burial Area. [see Figure 12, locations 4, 6, 7]

Care was taken that all areas of buried waste or scrap be identified and that radiation measurements be taken. The AEC also intended that the Navy and "any future land owner" be informed of the exact locations of burials with any future deed.<sup>78</sup> [See Appendix] Although this intention was clearly fulfilled in the transfer to the Navy and Mathieson Chemical Co., subsequent transfers of that portion of the LOOW did not include such information. The plot taken over by the Navy-Mathieson project included the land now occupied by SCA Chemical Waste Services Inc. The rediscovery some 15 years later of these same burials demonstrated how short lived the AEC's intentions were.

While it is possible that AEC could not have foreseen the transfer of the land to private hands, it is difficult to discern how such an explicit recommendation got lost in the subsequent shuffle of landowners.

"The U.S. Navy and any future land owner should be informed of the exact burial locations of the contaminated wastes. Figures 1-4 attached, and any additional information should be transmitted with the property deed."<sup>79</sup>

The scope of the cleanup presents an excellent example of the success of the AEC in dealing with radioactive waste and scrap. The 1970 survey found the same areas contaminated that were supposedly cleaned up in 1954 and 1955.<sup>80</sup> The 1950's era techniques of decontamination used by the AEC at LOOW included generally covering over burials to reduce exposure to workers and others at the site.<sup>81</sup> Scrap stored on the surface of the ground was manually picked up and consolidated at the now-smaller AEC area.

The difficulty the AEC and its successors have had in finding and cleaning up scrap and buried waste at LOOW is no doubt a function of the disorderly method by which the materials were first dumped at the site. The preparations for the 1954 clean-up indicate that it was the first time any charts or maps of the dumping grounds had been made. As discussed above (p. 234 supra) no records appear to have accompanied the shipments of waste from KAPL, another Navy contractor. The KAPL waste, however, was described as "highly irradiated" in the preparatory document for the Hooker clean-up.<sup>82</sup> Charts of the dumping grounds indicate that contaminated scrap was haphazardly strewn about the grounds in no apparant pattern.<sup>83</sup>

After the 1954-55 work, the land was turned over to Mathieson (the Navy contractor) and declared safe for their use "with the knowledge of existing burials as shown on the drawing." The Navy's use of the property lasted only briefly, and by 1957, the Air Force had plans to use the same site (Tract 3) for the production of high energy rocket fuel. General Services Administration, the government's housekeeping agency and a successor to War Assets Administration, assumed interim responsibility for the site after the Navy's project was abandoned. It would have been logical to assume that GSA would have been told about the radioactive burials, and the hazardous TNT waste lines which laced the property. Contained within the Tract 3 site, according to records which in 1957 were only a few years old, were:

1. TNT waste lines and the Redwater Ditch
2. Castle Garden Dump of radioactive materials
3. University of Rochester Burial Area
4. The First KAPL waste site near "M" Street and nearby burials.

GSA's knowledge of these hazards may have been nonexistent at the time the land was granted to the Air Force. The charts prepared in 1954 by AEC, Hooker and Mathieson appear not to have accompanied transfer papers from GSA to the Air Force. GSA's description of the buildings also seems at variance with the known history of the site. GSA declared that all buildings "were originally erected for atomic experiments and contain few, if any, features characteristic of conventional construction. All



are in poor state of repair."<sup>84</sup> Other records available to the Task Force give no indication of "atomic experiments" having been conducted in Tract 3 by the AEC, unless waste burials and scrap piles are considered "atomic experiments."

The Air Force's stated plans for the site included construction of various manufacturing facilities, an operation which could have disturbed the burials or the TNT lines. Since GSA provided no cautionary advice about the hazard, it is possible that GSA itself was unaware of the dangers that existed. Records of the "existing burials" had been prepared by AEC's Health and Safety Laboratory in 1954 to inform the Navy's contractor Mathieson Chemical Co. Mathieson was given this information.<sup>85</sup> Did they in turn pass it on to the General Services Administration?

D. Sale of Contaminated Land to Fort Conti Corporation

GSA sold the property, buried radioactive waste included, to Fort Conti Corp., on July 28, 1966 for \$91,580. Except for several easements which the government required, Fort Conti agreed only "that it will not use the land conveyed hereby as a garbage dump and will not litter or deposit any refuse or residuals on said land that would tend to breed vermin or cause obnoxious or noxious fumes or odors."<sup>86</sup> [See Appendix] The origin of the deed restriction is not clear. Two years before the sale, May 13, 1964, GSA amended its records to ensure that any subsequent transfer included the restriction. The papers making this amendment do not indicate at whose request the amendment was being made, or whether the provision was adopted

generally in all GSA deeds at that time. The covenant applied equally to Fort Conti's "successors and assigns", who so far have included Chem-Trol Pollution Services, Inc., a chemical waste processing firm, and its successor, SCA, which today operates chemical waste processing facilities, including lagoons, on the property.

1. Another Survey, Another Cleanup

Responding to local reports of radiation on privately owned land, AEC initiated another survey of the site in 1970, four years after the land generally comprising the old Navy-Mathieson Area had been sold to the Fort Conti Corporation, who ostensibly used the site as a hunting preserve. As a result of the 1970-71 survey, a major decontamination program was undertaken and completed in 1972, including the excavation and removal of more than 4,000 cubic yards of earth and materials. The decontamination was undertaken exclusively on the privately owned land found to contain the radioactive burials, with the material consolidated on the AEC's property to the south.

A second consequence of the "rediscovery" of the burials was the imposition of development restrictions by the State Health Department. The restrictions were imposed after the AEC refused to agree to a decontamination standard which met the state's standards. Although AEC wanted to decontaminate to levels not exceeding 50 uR/hr, the State had reason to be skeptical of AEC's ability to meet even its own goals. The 1954 cleanup had left behind several areas where radiation levels exceeded the goals and standards of that time. One such area identified by the 1970 survey (published January 15, 1971) was near the railroad bed by

"M" Street near the First KAPL waste site. A spot of contamination registering 50 millirems per hour was believed to be the location of a burial of contaminated material from Mallinckrodt Chemical Works (AEC's St. Louis contractor) which was buried, records reportedly indicated, April 20, 1953.<sup>87</sup>

In an attachment to the report of the survey, William T. Thornton, Health and Nuclear Safety Branch, AEC, reported to Wiley A. Johnson, chief of the branch, that

"survey evidence seems to confirm that radioactive material is indeed buried in areas on the Ft. Conti Corporation property. The burial areas are recorded on the Hooker Chemical Map A-D353 dated 9/1/54 and revised 4/30/57, and are indicated to be 700 feet<sup>2</sup> and 440 feet<sup>2</sup> respectively."<sup>88</sup>

B.M. Robinson, author of the report, stated that

"direct radiation levels are not sufficiently high to present obvious health hazards," within the areas of private ownership. "However, the radiation-contamination levels are about 50 times what is acceptable for release from AEC control and there is, at the very least, a very sensitive public relations situation."<sup>89</sup>

The discovery in 1970 that GSA had released land from its control with buried radioactive materials should have come as no surprise. The Hooker-era cleanup correspondence documented that the Navy and Mathieson were to occupy land which had known, "existing burials." But the fact that AEC had to rediscover these burials 15 years later reveals a startling and disturbing breakdown of institutional memory.

In response to the AEC's rediscovery of radioactivity on private lands in 1970, state officials pressed the Federal agency to perform a thorough cleanup of the non-government-owned land. The state officials, from the Departments of Health and

Environmental Conservation, urged that the clean-up of radiation reduce all levels below 20 microroentgens (uR/hr) per hour. AEC took the position that decontamination to 50 uR/hr would be sufficient to avert any hazard to human health.

After nearly a year of negotiations, no agreement had been reached between the state and the AEC. As a result, the Department of Health imposed development restrictions on 95 acres of formerly AEC-owned land then in possession of Chem-trol Pollution Services, Inc.<sup>90</sup> SCA, present owner of the facility, must currently request permission whenever it wishes to excavate on the site, so as to avoid known burials of radioactive waste. The Federal Government's dealings with the state over this issue will be discussed in more detail in the next section.

#### E. A Record of Incomplete Information

On several occasions over the years, officials of AEC misled state health and environmental officials about the nature and extent of the radiological hazard at LOOW.

##### 1. AEC Misled Public

An instance of misinformation purveyed by AEC occurred in its announcement to the public of the startup of the Boron-10 plant in the mid-1950s. In its announcement, AEC stated, "heretofore the commission has used the Lake Ontario Ordnance works for the storage of reusable chemical apparatus, drums, piping and equipment slightly contaminated by radioactive materials."<sup>91</sup> This description in no way includes the K-65, L-30, L-50, F-32, or R-10 storage, none of which could be described as "equipment slightly contaminated with radioactive

materials." The L-30, L-50, F-32 and K-65 sludges were stored in bulk, but were, by the time of this announcement, acknowledged contributors to contamination through the surface drainage system. The R-10 was stored in bulk in the open.

2. Eisenbud Misled State Health Commissioner

Another instance of how AEC misled the State occurred in 1959. State health officials had become concerned about the possibility of radioactive contamination of offsite surface waters, and Dr. Herman Hilleboe, Health Commissioner, asked AEC's Merrill Eisenbud, manager, Health and Safety Laboratory, for information.

Eisenbud's reply served to mislead state officials for years to come. Eisenbud stated:

"Relatively small quantities of radioactively contaminated materials have been stored at the Lake Ontario Storage Area since the early 1940s."<sup>92</sup>

The characterization of the wastes as "relatively small quantities" is misleading. In fact, more than 20,000 tons of materials were stored at LOOW at the time Eisenbud's statement was written, and storage operations continued throughout the 1940s and early 1950s. Eisenbud stated:

"Most of the material has been contained in drums or specially constructed storage facilities or stored in warehouses."<sup>93</sup>

In fact, none of the buildings containing waste, particularly the L-30 area, a former water tank, and the K-65 silo, a modified water tower, were "specially constructed" to hold anything radioactive. More than 8,000 tons of material, 40 per cent of the total, was stored in the open (the R-10 residues)

and was leaching radioactivity through the surface drainage system. Eisenbud stated:

"The only bulk material that has been stored unprotected on the ground was deposited in the period 1944 to 1946. This material, consisting of residues from uranium refining processes and containing trace amounts of uranium and radium, was removed in part in the summer of 1958; the balance remains in place."<sup>94</sup>

This description fairly accurately accounts for the R-10 residues, but fails to mention the problem of erosion which was noted as early as 1949.<sup>95</sup> Another significant element of the LOOW storage program which Eisenbud failed to discuss was the storage of KAPL wastes, plutonium and fission products. This omission is significant because for several years after this letter, radiological surveys conducted by the state looked only for radium, which Eisenbud's letter led officials to believe was the only contaminating element at the site. State environmental officials began to be concerned about fission products such as Cesium 137 only after Federal surveys identified it at the site in late 1970. Eisenbud stated:

"In 1949 this office conducted an off-site survey to measure uranium and radium in soil and water around the storage area. The results of that survey coupled with the fact that no bulk materials were added to the ground after 1946 lead us to the conclusion that (1) off-site contamination is limited to the area drainage ditch and Four Mile Creek into which the ditch flows and (2) the contamination is insignificant in terms of potential hazard."<sup>96</sup>

Eisenbud said he would welcome the state's cooperation in another survey, then described some details of the 1949 survey.

In fact, it would have been more relevant for Eisenbud to report on the 1953 survey which did measure offsite contamination up to three times background in the ditch and the creek. There

is no rationale for discussing only the 1949 report. Also, the 1949 report predated the arrival of the F-32, K-65 and KAPL waste, and contamination from these sources could not have been recorded until the 1953 report, the one Eisenbud ignored.

### 3. State Increased Surveillance

Shortly after Eisenbud's letter was received, State Health Department officials began preparations for their own survey of LOOW in search of radioactivity.<sup>97</sup> Samples taken by state workers were collected for radium analysis September 24, 1959<sup>98</sup> and sent to the AEC's Analytical Division for analysis. Measureable concentrations of radium were recorded by the analysts.<sup>99</sup>

Since the state had never been told about the temporary storage of fission products at LOOW, no effort was made to look for them at that time. The presence of particular radioactive substances can be recorded only when equipment is pre-programmed to look for them. Since state officials were told only about waste which would cause radium contamination, the first surveys were conducted to locate radium concentrations.

An example of how this dearth of information affected state surveys came in 1964, when Davies requested another survey of LOOW "similar to the conducted one (sic) in 1960."<sup>100</sup> AEC gave its approval April 10, 1964, but more than a year elapsed before specifications for the survey were forwarded to field engineers.<sup>101</sup> The specifications stated that samples of ground water, soil, surface water and bottom mud "would require a radium analysis only," because the site contained only "contaminated metal scrap and residue from uranium milling operations."<sup>102</sup>

No mention was made of fission products from Knolls Atomic Power Laboratory or animal wastes from the University of Rochester. As a result of this, so far as the Task Force could determine from records, no analysis or survey to identify other radioactive isotopes took place until the 1970 AEC survey which identified contamination on private lands.

In cases when state officials did obtain pertinent information about conditions at the site, prompt action usually followed. Shortly after the state's first survey was conducted, Davies increased the department's surveillance of LOOW. On August 11, 1960, Davies was informed by his district sanitary engineer in Lockport, that the K-65 storage silo was

"in a very poor state of repair. The surface of the silo, which is concrete, is spalling very badly in places, and wire-reinforcing which appears to be pre-stressed has deteriorated and in places is hanging down the side of the silo...It was learned at the time of the inspection that no past or future maintenance was scheduled."103

Davies took immediate action and on August 16 told AEC's division of Environmental Sciences that

"it is possible that your office would like to recommend to the responsible officials that some steps should be taken to preclude any further deterioration of this silo and the possibility of escape of any radioactive materials."104

AEC told Davies it had "been aware of this situation and last winter, at the direction of the New York Operations Office, binding rods were installed on the silo to compensate for possible loss of bursting strength." W. B. Harris, director of Environmental Sciences, said that step would be "adequate in regard to preventing inadvertant leakage or release of the



contents of the silo...for the duration of the anticipated use of the storage unit."<sup>105</sup>

F. Present Status

The present status of the LOOW site, now about 200 acres of land called DOE's Niagara Falls Storage Site, is predicated on the standby maintenance of stored radioactive waste: K-65, L-30, L-50, F-32 and R-10. African Metals Corp. must either remove materials it owns or forfeit them within the next few years (the lease of the K-65 storage tower expires in 1983), so the Department of Energy has begun preparation of several plans for decontamination and decommissioning of the site.

A 1977 study by National Lead Company of Ohio called for reduction of the size of the site to about 33 acres. It also recommended the further excavation and removal of contaminated earth, buildings and structures from the areas outside the smaller site. These would be consolidated on the remaining DOE property and maintained in perpetuity.<sup>106</sup>

But this plan presumed the eventual removal of all materials owned by African Metals Corp., a circumstance which is by no means probable. To remove the material in an environmentally acceptable manner may cost more than the material is worth in its recovery value. If this proves true, the Government may have to assume responsibility for its final disposition.

A recent comprehensive survey of the site by Battelle Columbus Laboratories for DOE was a preliminary step in preparing information on which decontamination plans will be based. The

Battelle study reconfirmed, but in much greater detail, much of the data generated in previous radiological surveys. The area found in 1970 to have Cesium 137 contamination was found again to be contaminated to 70mR/hr. The building housing the L-30 waste was found to be leaking residue into a canal under the F-32 tank, which was taking the fluid into the Central Drainage Ditch. The West Ditch was found to be receiving contamination from an area near the Baker-Smith storage facilities.<sup>107</sup> These areas of concern, and others mentioned in the Battelle report, are scheduled to be attended to as part of the decontamination of the DOE lands.

DOE is still concerned, however, about residual contamination of areas outside its present site. The department is once again making plans to survey land the AEC released from its control in 1955,<sup>108</sup> and the likely places of concern are generally the same as in the past:

1. Castle Garden Dump area.
2. Area North of "M" Street between the Campbell Street and Castle Garden Road Intersections.
3. Burial ground north of "M" Street along the Railroad (KAPL and Mallinckrodt areas). This area is now occupied by SCA's aqueous waste treatment area and the firm's offices and laboratories.
4. University of Rochester Burial Ground
5. Scrap Metal Disposal Area along the Railroad west of MacArthur Street. Officials do not know yet whether the area was cleaned up at all during the 1950's.

6. Area South of "O" Street northwest of the Vine Street Railroad Spur. Non-radioactive residue from hafnium/zirconium processing by Titanium Alloys Manufacturing Co. is buried here and is pyrophoric.

7. A scrap metal disposal area near the rail line in the southeast area of the old LOOW property. This area was cleaned up both in the 1950's by Hooker and in 1972.

8. An area near the western site boundary in the sewage treatment area. This area was supposedly decontaminated before being deeded to the Town of Lewiston in 1975, but DOE does not know precisely what cleanup effort was made, and the site is adjacent to the second storage site of KAPL waste, an area heavily contaminated with Cesium 137.<sup>109</sup>

The results of the next survey are likely to show that past cleanup and decontamination have not succeeded in ridding private lands of radiation resulting from past Federal dumping and burials.

Although DOE's long range plans call for decommissioning its present storage area, no decision has been made as to what extent and at what cost this will be accomplished. Cost estimates, reported in the August 1980 DOE Report, depending on the mode of decommissioning chosen, range from \$30,000 to \$20 million.<sup>110</sup>

## FINDING VII

IN 1954-1955, THE ATOMIC ENERGY COMMISSION PERMITTED CARBORUNDUM METALS CO. TO DUMP THOUSANDS OF GALLONS OF UNTREATED THIOCYANATE WASTES DIRECTLY INTO THE NIAGARA RIVER THROUGH THE OUTFALL SEWERS AT THE LAKE ONTARIO ORDNANCE WORKS.

### INTRODUCTION

The dumping of ammonium thiocyanate waste into the Lake Ontario Ordnance Works outfall sewer leading to the Niagara River, by Carborundum Metals Company in 1954-1955, represents another sorry chapter in the history of Federal Government involvement in the contamination of the Niagara Frontier. Throughout the year or so during which the dumping took place, all of the parties involved showed more concern for potential damage claims than they did for protecting the environment or public health. Wary that their actions might be illegal, officials of the Atomic Energy Commission, then custodians of the LOOW site, requested and received written directives from higher authorities authorizing the dumping. In addition, both Hooker (then maintenance contractor at the site) and AEC officials demanded, as a condition to their allowing the disposal operation, written assurance that their organizations would be held harmless from any claims of damage or injury due to the dumping.

A. Original Request by Carborundum for "Emergency Disposal"

In the early 1950's, the Carborundum Metals Company plant in Akron, New York, was under contract with the Atomic Energy Commission to refine hafnium and zirconium for the Commission's reactor materials program.<sup>1</sup> Wastes from the refining process had accumulated in a lagoon, which by February 1954 was filled to overflowing with 350,000 gallons of ammonium thiocyanate.<sup>2</sup> The refining process was adding to the lagoon at a rapid rate, but Carborundum was prohibited by the State Health Department from releasing the effluent to the nearby Tonawanda Creek because the creek flow was not sufficient to dilute the toxic wastes to safe levels.<sup>3</sup> Moreover, the Akron plant also released large quantities of cooling water containing hypochlorite, which when combined with thiocyanate produced soluble cyanides. Even modest releases from the lagoon, combined with the cooling water effluent, had caused fish to be killed in the creek.<sup>4</sup>

Because of these mounting difficulties with waste disposal, Carborundum asked AEC if it would permit the use of the LOOW sewer to empty the contents of the lagoon and thus allow production at the refinery to continue. Although the original request was to dump only the 350,000 gallons from the lagoon, at a rate of 12,000 gallons per day, documents obtained by the Task Force indicate that the dumping became standard procedure for more than a year, and that millions of gallons of the waste may ultimately have been disposed of through the LOOW sewer. AEC conditioned its approval of the dumping on three factors: 1) that the entire operation be performed at Carborundum's expense;

2) that AEC receive a letter from the State Health Department specifically permitting the discharge; and 3) that Carborundum hold both the AEC and Hooker Electrochemical Company harmless for any possible damages.<sup>5</sup> Hooker was involved at the site through its contract with AEC to design and operate the factory manufacturing the isotope Boron 10, and another contract to clean up the site's radioactive waste dumps. [See p. 255 supra.]

Although Carborundum's request was approved by the AEC, with concurrence from the State Health Department, the company temporarily withdrew its request in April because heavy rains had permitted it to increase the discharges from the lagoon to the creek in Akron while complying with legal pollution limits.<sup>6</sup> At this time Carborundum's vice president expressed to Hooker officials hope that the company would not have to renew its disposal request, although adding that "it is possible that at some future date we would again request permission" to dump the waste through the LOOW sewer.

In September 1954, the request was renewed,<sup>7</sup> and officials of Carborundum, AEC and Hooker met to work out details for the dumping operation and the liability each would assume. The group agreed that Hooker would allow Carborundum trucks to enter LOOW to dump the waste daily from 8 a.m. to 5 p.m., but Hooker would be held harmless for any damages resulting from the disposal operation.<sup>8</sup> [See Appendix]

Carborundum also agreed to hold AEC harmless for any claims resulting from the dumping.<sup>9</sup> Although this provision of their agreement was never tested legally, it is curious indeed that the

site owner, AEC, felt protected by only a letter from Carborundum.

B. New York State Health Department Conditional Approval

The New York State Health Department also approved the dumping operation, in a letter dated September 15, signed by A.F. Dappert, Executive Secretary. The state's approval, however, was clearly based on the belief that the dumping was necessitated by a temporary emergency. Dappert asked that the effluent be discharged to the river at a slower rate than Carborundum proposed, and that a holding basin be constructed to release the waste at a uniform rate. Further, Dappert expressed his hope that Carborundum would make progress toward a "permanent solution" to its waste problem so that the dumping at LOOW could be "discontinued as soon as possible."<sup>10</sup> [See Appendix]

C. AEC Headquarters Approval

At the same time that conditional state approval was being issued, local AEC officials requested explicit authorization from their headquarters in Oak Ridge prior to the arrival of the waste at LOOW.<sup>11</sup> Such approval was necessary in part because Hooker refused to go along with the scheme unless it received specific instructions from AEC. A LOOW site representative for AEC described Hooker's attitude in a memorandum to headquarters:

"Our contractor's attitude is one of distaste, since pollution of the waterways by chemical companies around Niagara Falls is a constant public relations issue. Therefore, in general they will take action in this matter only to the extent that they are specifically instructed by the AEC".<sup>12</sup> [See Appendix]

AEC officials forwarded their approval of this "emergency

procedure..for an unspecified period" on September 16, and the dumping commenced.<sup>13</sup>

D. One Year Later

One of the final ironies of the thiocyanate dumping incident is that in spite of all the reservations and expectations which officials had about it, the "emergency" dumping lasted at least a year. There is no indication in the documents reviewed as to when the disposal operations terminated or whether the Health Department conditions were complied with. If, as planned, disposal operations took place on a daily basis at the rate of 12,000 gallons per day, it is possible that between 20,000,000 and 30,000,000 gallons of this waste may have been dumped into the Niagara River through the LOOW sewer. In fact, it appears that the dumping of thiocyanate took place on a continuous basis following its commencement in 1954. In September 1955, Hooker complained that Carborundum's trucks had damaged the roadways leading into the site. Carborundum agreed to pay for repairs, and AEC approved continued dumping at the site. Even by 1955, AEC officials acknowledged that Carborundum had made no progress whatsoever in developing a disposal facility of its own, despite the requirement to do so in the original State Health Department grant of permission.<sup>14</sup>

Another irony is that in spite of the obvious reluctance of officials to take responsibility for the dumping, there is no evidence that Canadian authorities were notified of the incident, even though the Niagara River is an international waterway. In light of this, it seems evident that officials sanctioned an



incident which they knew was beyond the bounds of propriety, if not of law. It is noteworthy that no mention of the incident is made in the Interagency Task Force Report on Hazardous Wastes which was published in 1979. Since in the preparation of that report all of the agencies and companies involved in the thiocyanate incident were asked by the Interagency Task Force to detail their past waste disposal practices, the glaring omission of this episode calls into question the exhaustiveness of the record search and accuracy of the information supplied by the Department of Energy (AEC's successor) and Carborundum to the Interagency Task Force.