AERIAL PHOTOGRAPHIC ANALYSIS OF COMMERCE STREET PLUME SITE
Williston, Vermont
Volume 1

EPA Region 1

Superfund Records Center
SITE:
FRA:
OTHER:
AERIAL PHOTOGRAPHIC ANALYSIS OF
COMMERCE STREET PLUME SITE
Williston, Vermont

by

A. S. Kartman
Environmental Services
Lockheed Martin Services
Las Vegas, Nevada 89119

Contract No. EP-D-05-088

Work Assignment Manager

J. Lin
Landscape Ecology Branch
Environmental Sciences Division
Las Vegas, Nevada 89193-3478

ENVIRONMENTAL SCIENCES DIVISION
NATIONAL EXPOSURE RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
LAS VEGAS, NEVADA 89193-3478
NOTICE

This document has undergone a technical and quality control/assurance review and has been approved for publication by personnel of the U.S. Environmental Protection Agency, Office of Research and Development, Environmental Sciences Division, Landscape Ecology Branch at Las Vegas, Nevada. It is for internal Agency use and distribution only.
This report presents the findings from a historical aerial photographic analysis of the Commerce Street Plume site located near Kirby Corner, Chittenden County, Vermont. To perform the analysis, ten years of historical black-and-white, color, and color infrared aerial photographs were obtained to cover the period from 1937 through 2004. Efforts to procure photographs between the years 1943 through 1971 were unsuccessful. For the historical aerial photographic analysis, ten years of photography were analyzed, of which eight years were reproduced for inclusion in this report. The purpose of the historical aerial photographic analysis is to document environmentally significant activities, including changes to landscape morphology, patterns of hazardous waste disposal, and other observable conditions of environmental significance at this 15.5-hectare (38-acre) site. This report provides operational remote sensing information in support of remedial actions conducted by the Region 1 Office of the U.S. Environmental Protection Agency (EPA) under the Comprehensive, Environmental Response, Compensation, and Liability Act (CERCLA). This report is produced in two formats, a standard 11" x 12" format and an oversized 17" x 22" format. The oversized report is presented in two volumes: the first volume includes the text descriptions and photographic analyses, while the second volume contains the aerial photographs and interpretive overlays.

According to collateral information (EPA, 2008), contaminants have been identified in the groundwater beneath the Commerce Street Plume site. Historical records indicate former manufacturing and/or fabrication operations contributed to groundwater contamination. Of specific concern to EPA are the identification of disposal activities onsite and along Kirby Lane located west of the site. Also of concern to EPA are the identification of an onsite unlined wastewater lagoon and leach field, and also the location of an onsite groundwater divide. None of these features
were positively identified during this historical aerial photographic analysis of the Commerce Street Plume site. Other findings from the analysis revealed no buildings were onsite in 1937 or 1942. In 1972 seven buildings were located onsite. Activity within most of these buildings was probably small-scale manufacturing, parts, or supply outlets. The number of buildings onsite increased throughout the analysis, and in 2004, a total of twenty-one buildings were identified. Business operations within these buildings included small warehouses, professional office space, supply outlets, automotive repair, and light manufacturing. Throughout the study period, stains, possible stains, disturbed ground, ground scars, and possible dark-toned material were noted in association with the buildings. A cleared area was utilized as a staging area and a possible pit was noted. A linear trench was seen at a second cleared area and possible liquid leakage was noted from rectangular-shaped objects. All film used during this analysis was acquired during leaf-on conditions, thereby obscuring conditions and features below the tree canopy.

The EPA Environmental Sciences Division, Landscape Ecology Branch in Las Vegas, Nevada, prepared this report for the EPA Region 1 Superfund Division in Boston, Massachusetts, and the EPA Office of Superfund Remediation Technology Innovation in Washington, D.C.
## CONTENTS

<table>
<thead>
<tr>
<th>Abstract</th>
<th>iii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Methodology</td>
<td>4</td>
</tr>
<tr>
<td>Historical Aerial Photographic Analysis</td>
<td>8</td>
</tr>
<tr>
<td>Glossary</td>
<td>21</td>
</tr>
<tr>
<td>References</td>
<td>22</td>
</tr>
</tbody>
</table>

## FIGURES

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Site location map, Vermont</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Local site location map, Burlington and Essex Junction, Vermont</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Commerce Street Plume site, August 14, 1937</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Commerce Street Plume site, August 8, 1942</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Commerce Street Plume site, September 1972</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Commerce Street Plume site, September 29, 1980</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Commerce Street Plume site, May 6, 1984</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Commerce Street Plume site, May 14, 1986</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Commerce Street Plume site, May 8, 1993</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>Commerce Street Plume site, August 26, 2004</td>
<td>10</td>
</tr>
</tbody>
</table>
INTRODUCTION

This report presents the findings from a historical aerial photographic analysis of the Commerce Street Plume site (CERCLIS ID# VTD098352545) located near Kirby Corner, Chittenden County, Vermont (Figures 1 and 2). To perform this analysis ten dates of historical black-and-white, color, and color infrared aerial photographs were obtained to cover the period from 1937 through 2004. For the historical aerial photographic analysis, ten years were analyzed, eight of which (1937, 1942, 1972, 1980, 1984, 1986, 1993 and 2004) were reproduced for inclusion in this report. Efforts to procure photographs between the years 1943 and 1971 were unsuccessful. For this reason, there is a lapse of 28 years in the analysis of this site. The purpose of the historical aerial photographic analysis was to identify disposal activities onsite and along Kirby Lane located west of the site. Also of concern are the identification of an onsite unlined wastewater lagoon and leach field, and also the location of an onsite groundwater divide. This report provides operational remote sensing support for remedial actions conducted by the Region 1 Office of the U.S. Environmental Protection Agency (EPA) under the Comprehensive, Environmental Response, Compensation, and Liability Act (CERCLA).

The Commerce Street Plume site covers approximately 15.5 hectares (38 acres) and is currently located in an industrial zone between Williston and South Burlington, approximately 9.5 kilometers (6 miles) east of Lake Champlain. The Commerce Street Plume site is a rectangular-shaped area oriented from northeast to southwest. Williston Road comprises the northern boundary of the site. Additional site boundaries used in this analysis were provided by EPA and do not necessarily denote legal property lines or ownership.

Collateral information supplied by Region 1 (EPA, 2008) states that contaminants have been identified in the groundwater beneath the Commerce Street Plume site. Historical records indicate former manufacturing and/or fabrication operations on the site may have contributed to groundwater contamination.
Two areas of concern are referenced in the collateral information supplied by EPA. For purposes of this report, these two areas will be referred to Areas of Interest (AOI). These two Areas of Interest are believed to be potential sources of groundwater contamination. AOI-1 is comprised of four buildings, identified as B1, B2, B3, and B8. AOI-2 is comprised of one building, identified as B6 in this report.

Findings from this historical aerial photographic analysis show that throughout the latter part of the study period, light-manufacturing, supply businesses, warehousing operations, and professional offices occupied much of the site. In 1937 and 1942 the site was covered by grass and forest. An unnamed drainage channel traverses the site from northeast to southwest. Onsite runoff appears to flow east into this unnamed drainage channel. By 1972 (the first photograph to show buildings), seven buildings had been built on the site. Activity within these structures likely included light-manufacturing, and small parts and supply outlets. Possible stains, probable disturbed ground and possible dark-toned material were noted in the vicinity of the buildings. Two additional supply or light-manufacturing buildings were constructed by 1980. Medium-toned linear objects and light-toned rectangular-shaped objects were observed alongside building B5. In 1984, a total of ten buildings were observed on the site. Possible stains were noted near building B3, disturbed ground and ground scars were visible near the southern terminus of Commerce Street, and two large cleared areas were also on the site. One cleared area was located in the central part of the site and the second cleared area was in the southernmost part of the site. This southernmost cleared area appeared to be utilized as a staging area where a possible pit, probable containers and probable crates were located. By 1986 a total of eleven buildings, had been constructed. Activity within these buildings likely involved light-manufacturing and parts and supply outlets. A trench was located at a former cleared area, possibly in anticipation of future development. The southernmost cleared area remained devoid of vegetation and continued to be used as a probable staging area where four possible containers were noted. By 1993, a total of eighteen buildings appeared to be used for parts and supply outlets, automotive work, office work, light-manufacturing, and warehouse operations. Ground stains were identified alongside buildings B10 and B17. A large mound of light-toned material, and possible liquid
leakage could be seen adjacent to building B15. In 2004, a total of twenty-one buildings had been constructed and appeared to be used for automotive work, parts and supply outlets, professional office space, light-manufacturing, and warehouse operations.

Of specific concern to EPA are the identification of disposal activities onsite and along Kirby Lane located west of the site. Also of concern to EPA are the identification of an onsite unlined wastewater lagoon and leach field, and also the location of an onsite groundwater divide. However, disposal activities, a wastewater lagoon and leach field, and an onsite groundwater divide could not be identified during this historical aerial photographic analysis. Surface runoff appears to flow east into an unnamed drainage channel, and then south into Muddy Brook.

The report is produced in two formats, a standard 11" x 12" format and an oversized 17" x 22" format that is presented in two volumes. Volume 1 contains the text of the report, including the Introduction, Methodology, and Photographic Analysis sections. Volume 2 contains the various maps and the photographs, with respective annotated overlays.

A Glossary, defining features or conditions identified in this report, follows the Historical Aerial Photographic Analysis section. Sources for all maps, aerial photographs, and collateral data used in the production of this report are listed in the References section. A list of all aerial photographs that were identified and evaluated for potential application to this study can be obtained by contacting the EPA Work Assignment Manager. Historical aerial photographs used in the analysis of this site have been digitally scanned and printed for use in this report. A transparent overlay with interpretative data is affixed to each of the digital prints. See the Methodology section for a discussion of the scanning and printing procedures.

The EPA Environmental Sciences Division, Landscape Ecology Branch in Las Vegas, Nevada, prepared this report for the EPA Region 1 Superfund Division in Boston, Massachusetts, and the EPA Office of Superfund Remediation Technology Innovation in Washington, D.C.
METHODOLOGY

This report was prepared using a standard methodology that includes the following steps:

- data identification and acquisition,
- photographic analysis and interpretation, and
- graphics and text preparation.

These steps are described below. Subsections also address details related to specific kinds of analyses that may be required to identify environmental features such as surface drainage and wetlands. All operational steps and processes used to perform this work (including data identification and acquisition, photographic analysis and interpretation, and graphics and text preparation) adhere to strict QA/QC guidelines and standard operating procedures (SOPs). These guidelines and procedures are documented in the Master Quality Assurance Project Plan (QAPP) prepared for Remote Sensing Support Services Contract No. EP-D-05-088 (LMS, 2006).

Data identification and acquisition included a search of government and commercial sources of historical aerial film for the study area. Photographs with optimal spatial and temporal resolution and image quality were identified for acquisition. In addition, U.S. Geological Survey (USGS) topographic maps were obtained to show the study area location and to provide geographic and topographic context.

To conduct this analysis, the analyst examined diapositives (transparencies) of historical aerial photographs showing the study area. Diapositives are most often used for analysis instead of prints because the diapositives have superior photographic resolution. They show minute details of significant environmental features that may not be discernible on a paper print.

A photographic analyst uses a stereoscope to view adjacent, overlapping pairs of diapositives on a backlit light table. In most cases,
The stereoscope is capable of various magnifications up to 60 power. Stereoscopic viewing involves using the principle of parallax (observing a feature from slightly different positions) to observe a three-dimensional representation of the area of interest. The stereoscope enhances the photo interpretation process by allowing the analyst to observe vertical as well as horizontal spatial relationships of natural and cultural features.

The process of photographic analysis involves the visual examination and comparison of many components of the photographic image. These components include shadow, tone, color, texture, shape, size, pattern, and landscape context of individual elements of a photograph. The photo analyst identifies objects, features, and "signatures" associated with specific environmental conditions or events. The term "signature" refers to a combination of components or characteristics that indicate a specific object, condition, or pattern of environmental significance. The academic and professional training, photo interpretation experience gained through repetitive observations of similar features or activities, and deductive logic of the analyst as well as background information from collateral sources (e.g., site maps, geologic reports, soil surveys) are critical factors employed in the photographic analysis.

The analyst records the results of the analysis by using a standard set of annotations and terminology to identify objects and features observed on the diapositives. Significant findings are annotated on overlays attached to the photographic or computer-reproduced prints in the report and discussed in the accompanying text. Annotations that are self-explanatory may not be discussed in the text. The annotations are defined in the legend that accompanies each print and in the text when first used.

Objects and features are identified in the graphics and text according to the analyst's degree of confidence in the evidence. A distinction is made between certain, probable, and possible identifications. When the analyst believes the identification is unmistakable (certain), no qualifier is used. Probable is used when a limited number of discernible characteristics allow the analyst to be reasonably sure of a particular identification. Possible is used when only a few characteristics are discernible, and the analyst can only infer an identification.
The prints in this report have been reproduced, either by photographic or computer methods, from the original film. Reproductions are made from the original film and may be either contact (the same size) prints or enlargements, depending on the scale of the original film. Any computer-produced prints used in this report are generated from scans of the film at approximately 1,300 dots per inch (dpi) and printed at 720 dpi. Although the reproductions allow effective display of the interpretive annotations, they may have less photographic resolution than the original film. Therefore, some of the objects and features identified in the original image and described in the text may not be as clearly discernible on the prints in this report.

Study area boundaries shown in this report were determined from aerial photographs and from information supplied by EPA Region. Boundaries used in this report do not necessarily denote legal property lines or ownership.

Digital Diapositives

Some film vendors no longer supply analog film products (e.g., diapositive transparencies) to their customers. Digital files, created by scanning the original analog film products, are provided. The digital file, a representation of an original analog film product, can be analyzed either by computer viewing techniques or by creating a secondary diapositive from the digital file and viewing the secondary diapositive on a light table. The result of this process of converting an analog diapositive image to a digital file may be a reduction in the photographic resolution. A potential consequence of this in the realm of aerial photographic analysis is a lower confidence in the identification of features or conditions of environmental significance. For example, what may have been identified with certainty as "a drum" on the analog version of the diapositive may, on the digital diapositive, only be determined to be "a probable drum."
Color Infrared Photographs

Some photographs used for this analysis were made from color infrared film. Normal color film records reflected energy in the blue, green, and red portions of the electromagnetic spectrum. Color infrared film differs in that it is sensitive not only to reflected blue, green, and red energy, but also to reflected energy in the infrared portions of the electromagnetic spectrum; however, the blue energy is filtered out and only the green, red, and infrared energy is recorded. When color infrared film is processed, it displays "false" colors that do not correspond with the true colors of the features photographed. For example, features that are highly reflective in the infrared portion of the spectrum, such as healthy vegetation, appear red to magenta on color infrared film. The false color displayed by a feature is produced in accordance with the proportions of green, red, and infrared energy it reflects. These portions are referred to as the "spectral reflectance characteristics" of the feature. To interpret the true color of a particular feature accurately from color infrared film, a knowledge of the spectral reflectance characteristics of that feature is required. This information is not readily available for the majority of features identified in this report. Therefore, unless otherwise indicated, no attempt has been made to interpret the true colors of the features identified on the color infrared film analyzed for this report.

Surface Drainage

The surface drainage analysis produced for this report identifies the direction and potential path that a liquid spill or surface runoff would follow based on the topography of the terrain and the presence of discernible obstacles to surface flow. The analyst determines the direction of surface drainage by stereoscopic analysis of the aerial photographs and by examining USGS topographic maps. Site-specific surface drainage patterns are annotated on the map or photo overlay. Where the direction of subtle drainage cannot be determined, an indeterminate drainage line symbol is used. Regional surface flow is ascertained from the USGS topographic maps.
HISTORICAL AERIAL PHOTOGRAPHIC ANALYSIS

The Commerce Street Plume site is located between the cities of Williston and South Burlington, Chittenden County, Vermont. The site covers approximately 15.5 hectares (38 acres) along State Route 2 (Williston Road). Surface elevations range from approximately 107 meters (350 feet) above sea level along Williston Road to 104 meters (340 feet) in the southern part of the site (USGS, 1987). A surface drainage divide was not identified on this site. Runoff from the site trends to the east and south into an unnamed drainage channel. This unnamed channel directs runoff to the south and then connects to Muddy Brook. Muddy Brook empties into Winooski River a major tributary leading to Lake Champlain located west of the site.

AUGUST 14, 1937 (FIGURE 3)

Dirt Road-1 (future location of Commerce Street) extends from Williston Road southwest through the center of the site and terminates at the fringe of a forested (FOR) area that covers the southern portion of the site. No evidence of activity is noted at the terminus of this dirt road and there is no break in the forest canopy, indicating the dirt road may not extend into the forest. Adjacent to Dirt Road-1 are two areas comprised mainly of bare soil (BS), although scattered vegetation (VEG; grass and small shrubs) are also present at the areas. Both areas appear to be accessed by Dirt Road-1. To the east, along the site boundary is a small depression (DEP) also comprised of bare soil and vegetation, however, there is no visible access to the depression. Off-site, Dirt Road-2 extends southeast from South Brownell Road to a small patch of disturbed ground (DG) near the western site boundary. No other environmentally significant activity is observed. Grass and shrubs cover the remaining portions of the Commerce Street Plume site. An unnamed drainage channel lined with trees and small shrubs directs runoff to the south. This unnamed channel originates north of the site and runoff (not visible) appears to flow underneath Williston Road, although a culvert is not discerned. In the extreme southern part of the site, this drainage channel
joins a second unnamed drainage channel. This second unnamed drainage originates northeast of the site. A culvert (not annotated) directs runoff underneath Williston Road.

Scattered residential homes (RES), farmsteads, and expansive agricultural fields (AG) surround the site.

North of the site a dirt road (not annotated) connects Williston Road to a rectangular-shaped area where possible scattered debris (DB) and possible derelict equipment (DER EQ) are noted. The origin of an unnamed drainage channel is noted just east of this rectangular-shaped area.
Very little change is observed at the Commerce Street Plume site. Dirt Road-1 that appears to terminate at the fringe of the forest, the two areas of bare soil, and the depression remain visible. Within each of these features, vegetation or scattered vegetation are also noted, suggesting activity is minimal. Off-site, part of Dirt Road-2 is not visible due to crops in an agricultural field. The central and eastern parts of this dirt road do remain visible, although this dirt road appears more densely vegetated than in 1937. Dirt Road-2 terminates at the western site boundary (the same location noted in 1937), but the area of disturbed ground can no longer be identified. It is likely this dirt road and former area of disturbed ground have experienced minimal or no recent usage. Grass, shrubs, and trees cover the remaining portions of the Commerce Street Plume site.

Scattered residential homes, farmsteads, and expansive agricultural fields continue to surround the site.

North of the site, the possible scattered debris and possible derelict equipment noted in 1937 are no longer evident. However, a collection of possible derelict equipment is observed nearby. A portion of the area has been converted to a small agricultural plot (not annotated). The dirt road (not annotated) seen in 1937 extends through this small agricultural area and then curves around near two piles of probable light-toned material (LTMM). The road near these piles is vegetated (not annotated), indicating minimal recent usage.
SEPTMBER 1972 (FIGURE 5)

Efforts to procure photographs between the years 1943 through 1971 were unsuccessful. Therefore, there is a lapse of 28 years in the analysis of this site.

Seven buildings (B) have been built on the Commerce Street Plume site since 1942. For purposes of this report, all buildings (with the exception of residential structures) will be assigned a designated number. When environmentally significant activity is observed near a building, this activity will be described in the text. All buildings mentioned in this report are understood to have some level of activity within them.

Two Areas of Interest (AOIs) are believed to be potential sources of groundwater contamination. AOI-1 is comprised of three buildings, identified as B1, B2, and B3. AOI-2 is comprised of one building, identified as B6 in this report.

Dirt Road-1 seen on previous photographs has been paved and is now Commerce Street. The visible portion of this street terminates at the fringe of the forested area that now covers approximately two-thirds of the site. Two piles of uniformly-textured, probable light-toned mounded material are observed in the forest near the terminus of Commerce Street.

On the east and west sides of Commerce Street, new buildings varying significantly in size have been constructed since 1942. In the northeast part of the site is AOI-1. No environmentally significant activity is observed near building B1. Immediately southeast of building B2 are two possible transshipment trailers (TT) and a rectangular-shaped area comprised of possible disturbed ground and possible dark-toned material (DTM). Adjacent to building B3 are a possible ground stain (ST), and a small probable open storage area (OS) where several light-toned (LT) rectangular-shaped (RECT) objects (OBJ) are stored. The size and shape of buildings B1, B2, and B3 indicates they are likely used for parts and supply operations or small-scale manufacturing. Much of the ground surface between these three buildings is covered with grass (not annotated) or has been paved or covered with fine gravel for parking purposes. South of AOI-
is building B4, a small patch of dark-toned material is observed. This structure may be involved with storage or transshipment of finished products.

Northwest of building B4 is AOI-2 where building B6 has been constructed. No significant environmental activity is observed near this building. Surface conditions at this AOI include a small parking area (not annotated), a grassy area (not annotated), and a tree canopy. This tree canopy is also visible on all subsequent photographs used in this analysis, therefore reducing photographic interpretation methods by obscuring conditions and features below the tree canopy. Farther north there are a residence and building B7. Trail-1 terminates at the west side of building B7. Trail-1 exits the western site boundary, traverses south through an off-site forested area, and terminates at a patch of disturbed ground near the western site boundary. This trail is wide enough for vehicles and follows part of Dirt Road-2 seen on previous photographs. Also visible is Trail-2, which terminates at the same area of disturbed ground. This trail leads to an off-site location where uniform light-toned mounded material and a small pool of probable standing liquid (SL) are noted. These two features are associated with a large area of disturbed ground where two large sheds (not annotated) are being constructed.

The depression seen on previous photographs cannot be identified on this image, possibly due to the tree canopy.

Residential development near the site has increased since 1942. A residential development is observed north of the Commerce Street Plume site near to where scattered debris and possible derelict equipment was seen in 1937 and 1942. These features are no longer evident and may be obscured by dense vegetation or the tree canopy. Residential development is also noted along South Brownell Road. Industrial (IND) development is seen along Industrial Road to the northwest, and commercial (COMM) development is seen southeast of the site. Farmsteads and expansive agricultural fields remain noted.
SEPTEMBER 29, 1980 (FIGURE 6)

Nine buildings are now visible at the Commerce Street Plume site. At AOI-1 in the northeast section of the site, new building B8 (light-manufacturing or supply operation) has been constructed since 1972. Two probable transshipment trailers are visible within AOI-1. No environmentally significant activity is observed near buildings B1, B2, or B3. There is no evidence of the probable disturbed ground and possible dark-toned material seen in 1972. The area noted as a possible ground stain in 1972 may have been paved, and the small probable open storage area is no longer in use. Much of the ground surface between these four buildings remains covered with grass or trees (not annotated) or is paved or covered with fine gravel for vehicle parking.

On the west side of Commerce Street there is a square-shaped cleared area (CA) just south of building B5. This cleared area is likely being readied for future development. Building B5, visible in 1972 has a new building addition. Three medium-toned (MT), linear-shaped (LIN) objects are visible alongside three light-toned, rectangular-shaped objects near building B5. Two of these rectangular-shaped objects are approximately the size of an automobile, and the third object is roughly one-half that size. At AOI-2 just to the north, a tree canopy is obscuring features and conditions near the ground surface; therefore, no significant environmental activity is discerned.

Commerce Street has been extended south and appears paved for most of its length. The southern third of this street is probably dirt. The areal extent of the forested area, which in 1972 covered approximately two-thirds of the site, has been reduced due to the addition of new buildings and a square-shaped cleared area near the southern site boundary. A patch of bare soil is also noted within this cleared area.

West of the Commerce Street Plume site, most of Trail-1 seen in 1972 remains visible, except for the portion of this trail seen near building B7 where the tree canopy likely obscures it. At the southern terminus of this trail is the patch of disturbed ground also seen in 1972. Trail-2 is no longer visible.
Scattered residential development has increased west of the site. New industrial development continues to the north along Industrial Road. Expansive agricultural fields remain noted to the west, south, and east of the site.
Ten buildings are now present at the Commerce Street Plume site. Since 1980, Commerce Street has been extended farther south nearing the southern site boundary and a new building (B10). At AOI-1 on the east side of Commerce Street, possible stains and two possible transshipment trailers are noted in the vicinity of building B3. No other environmentally significant activity is observed within AOI-1. Farther south are two irregularly-shaped cleared areas, both located on the east side of Commerce Street. No environmentally significant activity is seen within the cleared area in the central portion of the site. At the southernmost cleared area a possible pit is observed. In addition, a small, well-organized staging area includes a probable transshipment trailer, and several probable containers (CONT) and probable crates (CR). The southern extent of this cleared area is comprised of disturbed ground and ground scars (GS). These ground scars may indicate ongoing activity in this area as evidenced by the possible vehicles parked at this location.

On the west side of Commerce Street, just south of building B10, there are a probable transshipment trailer and an open storage area where probable containers and probable crates are noted. A second probable transshipment trailer is observed adjacent to building B10 that has been constructed on the square-shaped cleared area seen in 1980. The size and shape of this building, and the open space around it, indicate a possible automotive repair facility. Near building B5 to the northeast there are dark-toned material and an open storage area where possible crates and containers are noted. At AOI-2, located to the north of building B5, a tree canopy continues to cover most of this area and no significant environmental activity is discerned. A probable light-toned circular (CIR) object is visible alongside building B7.

The patch of disturbed ground seen near the western site boundary and Trail-1 since 1972 are no longer visible due to the undisturbed regrowth of vegetation.

Very little residential, industrial, or commercial development has occurred around the site since 1980. Expansive agricultural fields remain noted near the site.
MAY 14, 1986 (FIGURE 8)

The 1986 photographs have less resolution than other photographic coverages used in this report. Therefore, features visible on earlier dated photographs may not be discernible on the 1986 photographs and the following analysis is not as detailed.

Eleven buildings are visible at the Commerce Street Plume site. No environmentally significant activity is observed within AOI-1 at the northeast corner of the site. Alongside building B4 is a patch of dark-toned material. Farther south, the cleared area seen in 1984 is mostly overgrown with grass and other vegetation but remains surrounded by large trees (not annotated) that were not cleared in the early 1980s. A small opening, wide enough for vehicles, breaks the line of trees along Commerce Street. No vehicles or heavy equipment are seen at this opening or within the former cleared area. However, a linear-shaped trench indicates activity, possibly to channelize onsite drainage patterns in anticipation of future development. The probable staging area in the southeast corner of the site remains devoid of vegetation, indicating continued activity. There are a total of four possible containers and a possible transshipment trailer noted at this location. The possible pit seen in 1984 cannot be identified on this image.

On the west side of Commerce Street, a tree canopy continues to obscure surface conditions within most of AOI-2. No significant environmental activity is observed within this area.

A new residential development is visible adjacent to Kirby Lane immediately west of the site. No significant environmental activity is visible within this residential development. Minor increases to industrial and commercial land uses are noted as well. Expansive agricultural fields remain near the site.
A total of eighteen buildings are now located on Commerce Street which has been extended south to the site boundary. This street appears paved for most of its length. The areal extent of the forested area, which in 1986 covered approximately one-half of the site, has been further reduced due to the construction of new buildings B11 through B18.

In the northeast corner of the site there is no environmentally significant activity observed within AOI-1. A transshipment trailer is parked alongside building B3 and just to the south, adjacent to building B4. Probable standing liquid is observed near new building B14. Farther south near new building B15 is uniform light-toned mounded material. This material does not appear to be part of an on-site industrial or manufacturing process and may represent extra fill material not used during past construction. Just south of this building are probable dark-toned material and five, light-toned rectangular-shaped objects. Three of the objects are approximately the size of an automobile and two objects are roughly one-half times larger. Darkened streaks emanating from several of these objects suggests possible liquid leakage. The slope of the ground surface directs the possible liquid leakage toward the unnamed drainage channel. In the far southeast corner of the site is new building B16, constructed on the former probable staging area seen in 1986. This building is probably a warehouse, involving storage and shipment activity as evidenced by the numerous (NUM) transshipment trailers parked on the fringes of the parking area and along the building perimeter. Two additional transshipment trailers and stacked crates are noted near the terminus of Commerce Street.

On the west side of Commerce Street new building B17 has been constructed adjacent to building B10. At what appears to be large openings to each of these buildings, ground stains are present. The total number of vehicles parked nearby relative to the size of the buildings appears excessive, evidence of a likely automotive repair facility. To the south are a possible shed and a transshipment trailer. Farther north, the tree canopy continues to obscure surface conditions within most of AOI-2; therefore, no environmentally significant activity can be discerned.
Several additional residences (not annotated) have been constructed along Kirby Lane immediately west of the site, but no environmentally significant activity is associated with this residential development. Minor increases to industrial land use and significant additions to commercial development have occurred since 1986, east and west of the Commerce Street Plume site. Expansive agricultural fields remain, but most are seen east of Essex Road.
AUGUST 26, 2004 (FIGURE 10)

A total of twenty-one buildings are now located along Commerce Street. New buildings B19 through B21 have been constructed since 1993. Business activity within these new buildings is likely associated with professional offices and supply outlets.

In the northeast corner of the site, a collection of small crates at an open storage area, and several transshipment trailers are seen in association with AOI-1. Just to the south, adjacent to building B4 is a large and well-organized open storage area where crates and containers of varying sizes are located. Farther south near building B15, the mound of uniform light-toned material seen in 1993 has been removed. South of this building, the possible liquid leakage and probable dark-toned material seen in 1993 are no longer visible. This may in part be due to a collection of several transshipment trailers and a U-shaped possible berm composed of light-toned material noted at that same location. Adjacent to the possible berm is a small probable open storage area where several crates are observed. In the far southeast corner of the site, numerous transshipment trailers continue to be observed on the fringes of the parking area and along the perimeter of building B16.

On the west side of the site near the terminus of Commerce Street is light-toned mounded material. This mound is composed of numerous dump-truck sized mounds of material that appear uniform in tone and texture. Scattered vegetation and small erosion rills are evident, indicating deposition of this material was not recent. To the north, a possible horizontal storage tank (HT) is located on the west side of building B10, but the ground stains seen near this building and building B17 in 1993 are no longer evident and may have been covered with new surface material. A transshipment trailer is seen alongside new building B20. Farther north, the tree canopy continues to obscure surface conditions within most of AOI-2; therefore, no environmentally significant activity can be discerned.

Offsite are light-toned mounded material and a large open storage where crates, containers, and dark-toned material are visible. This open storage area is affiliated with a large building where light-industrial
activity is likely. Additional commercial and light-industrial development has occurred around the site since 1993. A well-established residential community is located west of the site along Kirby Lane. No environmentally significant activity is associated with this residential development.
GLOSSARY

Building (B) - A relatively permanent, essentially boxlike construction having a roof.

Cleared Area (CA) - An area from which man has removed trees, shrubs, or other natural vegetative cover.

Container (CONT) - Any portable device in which material is stored, transported, handled, or disposed.

Dark- (DT), Medium- (MT), or Light-Toned (LT) - Tones of features in question are compared with the darkest and lightest tones of gray (if using B&W photography) on the print.

Debris (DB) - The remains of anything that can be identified as being broken down, destroyed, demolished, or dismantled.

Disturbed Ground (DG) - A rough area where the ground surface has been dug up or overturned.

Ground Scar (GS) - An area of bare soil, apparently the result of human activity.

Industrial Area - An area containing a wide array of land uses from light manufacturing to heavy manufacturing plants.

Light Industry - Industries focused on design, assembly, finishing, processing, and packaging of products.

Linear (LIN) - An adjective that describes the straight-line nature of features on the terrain or on maps and images.

Material (M) - Raw or waste materials on or in the vicinity of the site.

Mounded Material (MM) - Piles of raw or waste materials on or in the vicinity of the site.

Open Storage Area (OS) - An area of open-air (outdoor) storage of containerized, raw or waste materials, within industrial or manufacturing sites.

Pit - A steep-sided hole in the ground surface.

Stain (ST) - A residue or discoloration resulting from a spill, discharge, or removed/dispersed materials.

Standing Liquid (SL) - A small, shallow, temporary collection of liquid, not necessarily waste. Not to include liquid contained in impoundments, trenches, pits, etc.

Trench - A long, narrow excavation unrelated to drainage.
REFERENCES

MAPS

<table>
<thead>
<tr>
<th>Source</th>
<th>Figure</th>
<th>Name</th>
<th>Scale</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>USGS</td>
<td>1</td>
<td>United States</td>
<td>1:2,500,000</td>
<td>1972</td>
</tr>
<tr>
<td>USGS</td>
<td>2</td>
<td>Burlington, VT</td>
<td>1:24,000</td>
<td>1987</td>
</tr>
<tr>
<td>USGS</td>
<td>3</td>
<td>Essex Junction, VT</td>
<td>1:24,000</td>
<td>1987</td>
</tr>
</tbody>
</table>

COLLATERAL INFORMATION

EPA. 2008. Collateral data and site map supplied by EPA Region 1 as attachment to Remote Sensing Services Request Form.


AERIAL PHOTOGRAPHS

<table>
<thead>
<tr>
<th>Photo source</th>
<th>Figure</th>
<th>Date of acquisition</th>
<th>Original scale</th>
<th>Film type</th>
<th>Mission I.D.</th>
<th>Source frame #</th>
<th>EPIC ID #</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA</td>
<td>3</td>
<td>08-14-37</td>
<td>1:20,000</td>
<td>B&amp;W</td>
<td>NAS</td>
<td>41,42</td>
<td>141824,141825</td>
</tr>
<tr>
<td>NASA</td>
<td>4</td>
<td>08-08-42</td>
<td>1:20,000</td>
<td>B&amp;W</td>
<td>DCC</td>
<td>171,172</td>
<td>141826,141827</td>
</tr>
<tr>
<td>NASA</td>
<td>5</td>
<td>09-00-72</td>
<td>1:40,000</td>
<td>CIR</td>
<td>215</td>
<td>7-9</td>
<td>10849-10851</td>
</tr>
<tr>
<td>EPA</td>
<td>6</td>
<td>09-29-80</td>
<td>1:40,000</td>
<td>B&amp;W</td>
<td>50007</td>
<td>106,107</td>
<td>141828,141829</td>
</tr>
<tr>
<td>USDA</td>
<td>7</td>
<td>05-06-84</td>
<td>1:40,000</td>
<td>B&amp;W</td>
<td>487208</td>
<td>16-18</td>
<td>141830-141832</td>
</tr>
<tr>
<td>USDA</td>
<td>8</td>
<td>05-14-86</td>
<td>1:58,000</td>
<td>CIR</td>
<td>HAP 82</td>
<td>10-12</td>
<td>24639-24641</td>
</tr>
<tr>
<td>USDA</td>
<td>9</td>
<td>05-08-93</td>
<td>1:40,000</td>
<td>B&amp;W</td>
<td>NAPP</td>
<td>68,69</td>
<td>141833,141834</td>
</tr>
<tr>
<td>USDA</td>
<td>10</td>
<td>08-26-04</td>
<td>1:40,000</td>
<td>CC</td>
<td>NAIP04</td>
<td>52,53</td>
<td>DI0000154</td>
</tr>
</tbody>
</table>

*EPA U.S. Environmental Protection Agency, Environmental Sciences Division, Las Vegas, Nevada
NASA National Aeronautics and Space Administration, Houston, Texas
NAS/VIP National Aerial Survey Center Corp./Visual Image Presentations Silver Spring, Maryland
USDA U.S. Department of Agriculture, Salt Lake City, Utah
Photographs listed with no figure number were analyzed but not placed in this report.
B&W Black-and-white
CIR Color infrared
Digital diapositive (see Methodology section)