



The Environmental Photographic Interpretation Center (EPIC)

Introduction

EPA's Environmental Photographic Interpretation Center (EPIC) provides a wide range of remote sensing and aerial photographic analyses to EPA Headquarters and Regional Program Offices in support of investigations under Superfund, RCRA, the Clean Water Act and the National Contingency Plan. The comprehensive aerial photographic analyses are supported by a broad array of services including aerial photo overflight planning, collateral data acquisition, aerial film processing, historical aerial photo search and acquisition, and GIS data base development. EPIC produces fully annotated maps and photos accompanied by descriptive text to document historical or current analyses of hazardous waste disposal and handling, emergency response efforts and inventories of potential hazardous waste sites. Also provided are specialized analyses including wetlands classification and delineation, photogeology and fracture trace analysis and photogrammetric mapping. EPIC maintains a multidiscipline staff with backgrounds in geography, geology, biology, remote sensing, forestry and natural resources management.

The following sections present summary descriptions of EPIC's products and services.

Hazardous Waste Site Analysis

Analysis of hazardous waste sites using historical and current aerial photography comprises a major part of EPIC's workload. By utilizing the vast archives of nationwide aerial photography dating back to the 1930's which is maintained by government and private sources, EPIC's analysts can reconstruct the waste handling and disposal history of a site in support of site cleanup and regulatory or enforcement efforts. Aerial photography can be a powerful tool in court in the form of evidence and expert witness testimony.

Interpretation of aerial photography can yield information on site size, drainage patterns, type of fill materials, leachate, burial sites, lagoons, impoundments and their contents, and general condition of the site. Locations and descriptions of tanks, drums, open storage areas, evidence of vegetation stress, on-site obstacles, struc-

tures, equipment and access routes can also be provided. Historical analysis provides the information necessary to obtain a chronological understanding of a site's development and activities which can lead to the identification of a specific problem. The information interpreted from the photography is provided to the requester on photo enlargements, with overlays annotated with descriptive findings; accompanying text provides a full site description.

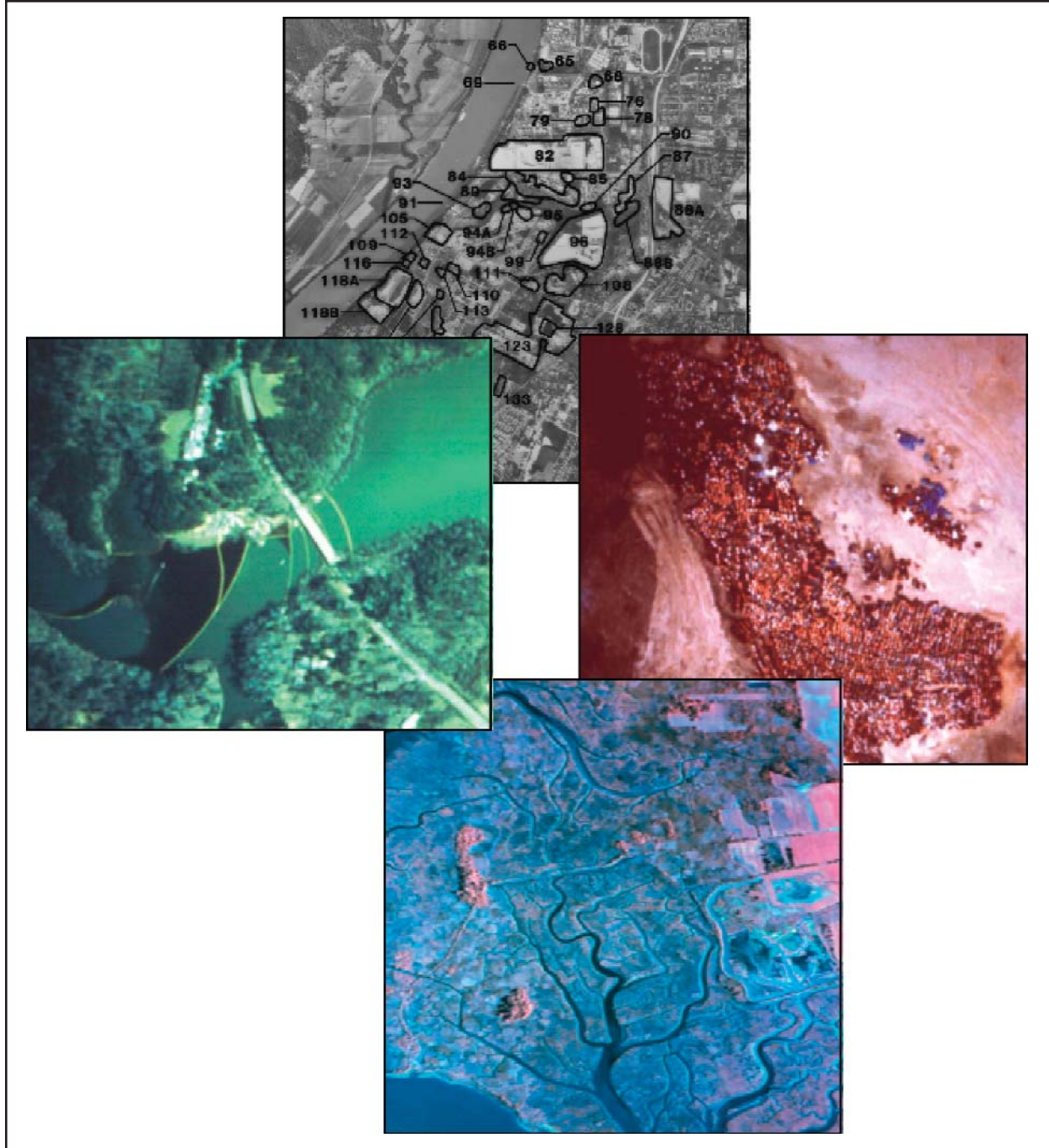
Inventories of Potential Hazardous Waste Sites

The site discovery process involves analyzing aerial photographs in order to cost-effectively inventory a large region of potential hazardous waste sites for further investigation. Aerial photographs are systematically searched for specific features or types of sites specified by the requester. These can include landfills, open dumps, scrap salvage yards, chemical handling and storage facilities, impoundments, or abandoned industrial sites. Identified sites are annotated on overlays to topographic maps and accompanied by data sheets describing site conditions. The site conditions are presented chronologically with the period of site activity shown on the map overlay. Historical aerial photographs are helpful for determining changing site conditions and for identifying hazardous sites that are currently hidden by new development.

Emergency Response

EPIC has quick response capabilities to react to emergency situations such as hazardous material releases and natural disasters like hurricanes (Hugo) and earthquakes (San Francisco/Oakland, CA). Aerial photography is acquired, processed and analyzed to provide information to on-site personnel regarding circumstances not easily or safely observed from the ground. Typical products for an emergency response project include an immediate telephone report to on-site personnel followed by photographs or positive film transparencies with interpretation results annotated on overlays, annotated topographic maps, and a short letter report describing analysis results.

The Environmental Photographic Interpretation Center (EPIC)



Figures: Clockwise starting at the top - an inventory of possible hazardous waste sites; Kingston Drum site, NH; false color image for wetland delineation and species identification; and an oil spill in a run near Manassas, VA.

The Environmental Photographic Interpretation Center (EPIC)

Wetlands

Wetland analyses are performed in support of various sections of the Clean Water Act concerning enforcement, permitting and advance identification. Analysis of historical aerial photography is often the only means of establishing the prior existence of wetlands on lands that have been dredged or filled, and calculating wetland loss acreage necessary for mitigation settlements. Aerial photographs can also provide information concerning vegetative type, periodicity of flooding, tidal influences, and affected drainage patterns.

A hierarchical wetlands and deepwater habitats classification system developed by Cowardin et al. for the US Fish and Wildlife Service is used in the analyses. Jurisdictional delineation procedures are followed in the field according to the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands*. Field checking of representative areas is performed in enforcement cases to verify the accuracy of interpretation and classification. Also checked are representative wetlands in proximity to, and matching the aerial photographic signatures of those at the site being investigated prior to its alteration. This information provides the analyst with an indication of the types of wetlands which were most likely present prior to alteration.

Simplified studies are also performed on Superfund sites or on areas where delineation between upland and wetland is needed. These studies entail the placement of wetland symbols or the delineation of wetland boundaries on overlays to photographic prints. The aerial photographic analysis is supported by collateral information regarding the soils, hydrology and local vegetation.

Photogeology

Photogeology involves the interpretation of an area's geology from analysis of landforms, drainage, tones, and vegetation distribution on aerial photographs. EPIC produces four types of photogeologic products: fracture trace analyses, karst feature identification, seep/spring detection and channel change analysis.

Fracture trace analysis involves the use of aerial photographs and other types of remotely sensed imagery to identify linear features on the earth's surface that are naturally occurring and are surface manifestations of subsurface fracture zones in the bedrock. When viewed in cross-section, fracture traces are seen to be vertical or near vertical breaks in the bedrock. Fractures are of

particular environmental concern because contaminants are likely to move more easily through zones of fractured bedrock than through the surrounding more consolidated bedrock material. Thus, fracture traces can be used to identify possible migration routes of pollutants and are often used in the placement of monitoring/remedial wells around hazardous waste sites.

Lithologic mapping (mapping of distinct rock types or units) from aerial photographs involves the interpretation of surface features in order to produce a more accurate geologic map in areas where geologic mapping is incomplete due to limited field work, small map scale, etc.

Photogrammetric Mapping

EPIC produces highly accurate topographic and planimetric maps, generally at a large scale, which conform with National Map Accuracy Standards and EPA Photogrammetric Mapping Specifications. Map scales, contour intervals, and planimetric details can be varied to suit specific requirements.

Photogrammetric techniques can be used to measure the area and volume of hazardous wastes; determine the height and placement of containment berms, dikes, and impoundments; and determine the depth of waste pits. Changes in size, shape, and other physical characteristics of a waste site can be documented through sequential photogrammetric mapping.

Photogrammetric techniques can also be used in establishing precise location and orientation data to support geophysical monitoring or monitoring well placement.

Geographic Information Systems

EPIC maintains an active GIS capability to support EPA Regional office needs. For example, one completed project supported a National Priorities List (NPL) hazardous waste site investigation using information from diverse sources (including numerous years of historical aerial photography, geological data, digital line graph data, soil data, property ownership, monitoring well data, etc.). This data was combined to produce topical maps and analyses for use in the Remedial Investigation/Feasibility Study decision-making process under Superfund. Another project involved the ecological characterization of a pilot site using photo-derived information on land use, vegetation, wetlands and landforms to produce maps and overlays for landscape

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characterization and trend analysis. Additionally, a GIS has been used to obtain wetland gain and loss measurements for enforcement actions against violations of the Clean Water Act.

Miscellaneous Analyses

Additional analyses include interpretation of thermal infrared imagery for detection of illegal river discharges and landfill and mine fires; detection of abandoned oil, gas and water wells; mapping of submerged aquatic vegetation; and land use and drainage mapping.

Data Acquisition

EPIC acquires historical photographs, dating to the late 1930's, from a wide range of Federal, state and local government agencies and private aerial survey companies. Current overflights, customized to the requester's needs as to scale, imagery type, time of year, etc. are obtained through a network of private aerial survey companies across the country. These companies are also available on short notice for emergency response efforts. Additional sources of information acquired include U.S. Geological Survey maps, Sanborn Fire Insurance Maps and U.S. Department of Agriculture Soil Surveys.

Photo Lab

The technical services of EPIC include aerial photographic print production using digital scanning methods and/or photographic laboratory film processing:

- Complete digital or photographic processing and printing of black-and-white, color, color infrared, and black-and-white thermal infrared film;
- Custom processing and printing, to include reproducing old maps, line work, and historical imagery.

Graphics Support

EPIC offers graphics, cartographic, drafting and ancillary support for the preparation of finished documents. Our present capabilities include:

- Preparing inked overlays keyed to aerial photographs and maps, and preparation of transparencies for use as overlays or in briefings;
- Assembling completed reports including layout, mounting of photographs and text, covers, and binding;
- Mounting and labeling of photographs for litigation or public hearings.