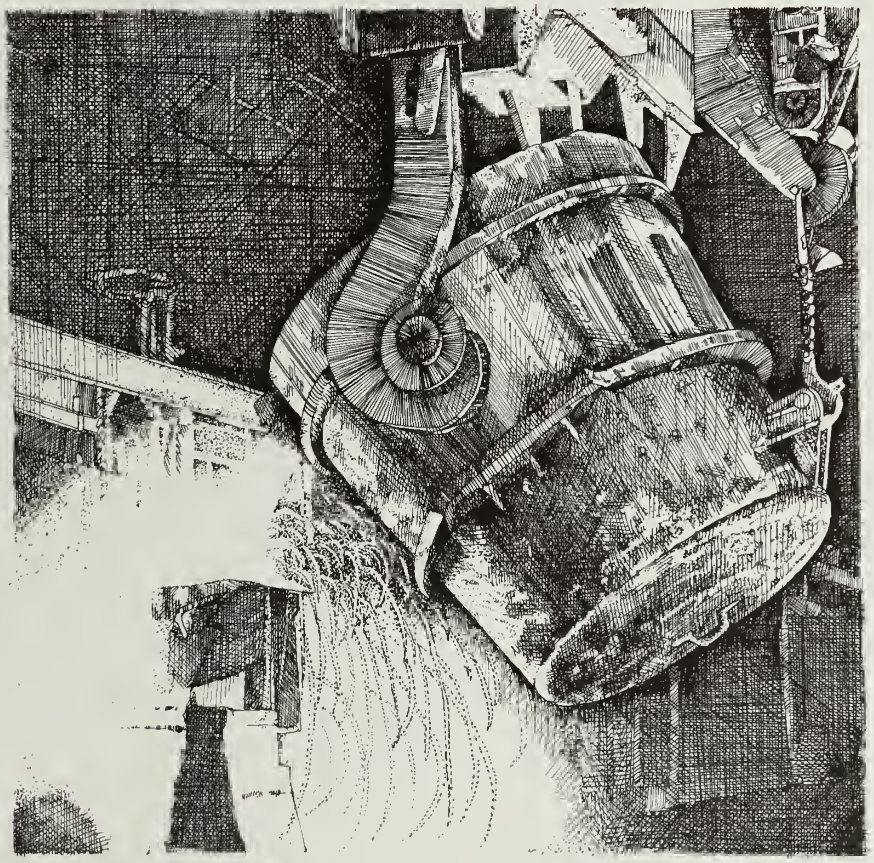
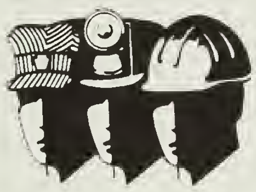


recommendations of the large industrial artifact advisory panel

AMERICA'S INDUSTRIAL HERITAGE PROJECT • PENNSYLVANIA

UNITED STATES DEPARTMENT OF THE INTERIOR/NATIONAL PARK SERVICE

recommendations of the large industrial artifact advisory panel



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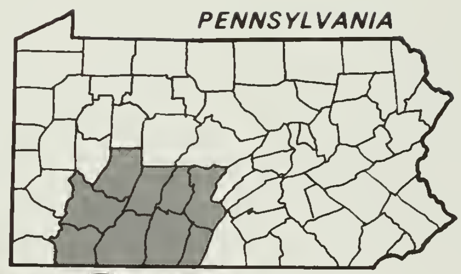

AMERICA'S INDUSTRIAL HERITAGE PROJECT

• KEY CULTURAL FEATURE OR REGIONAL ATTRACTION

0 5 10 15 MILES

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

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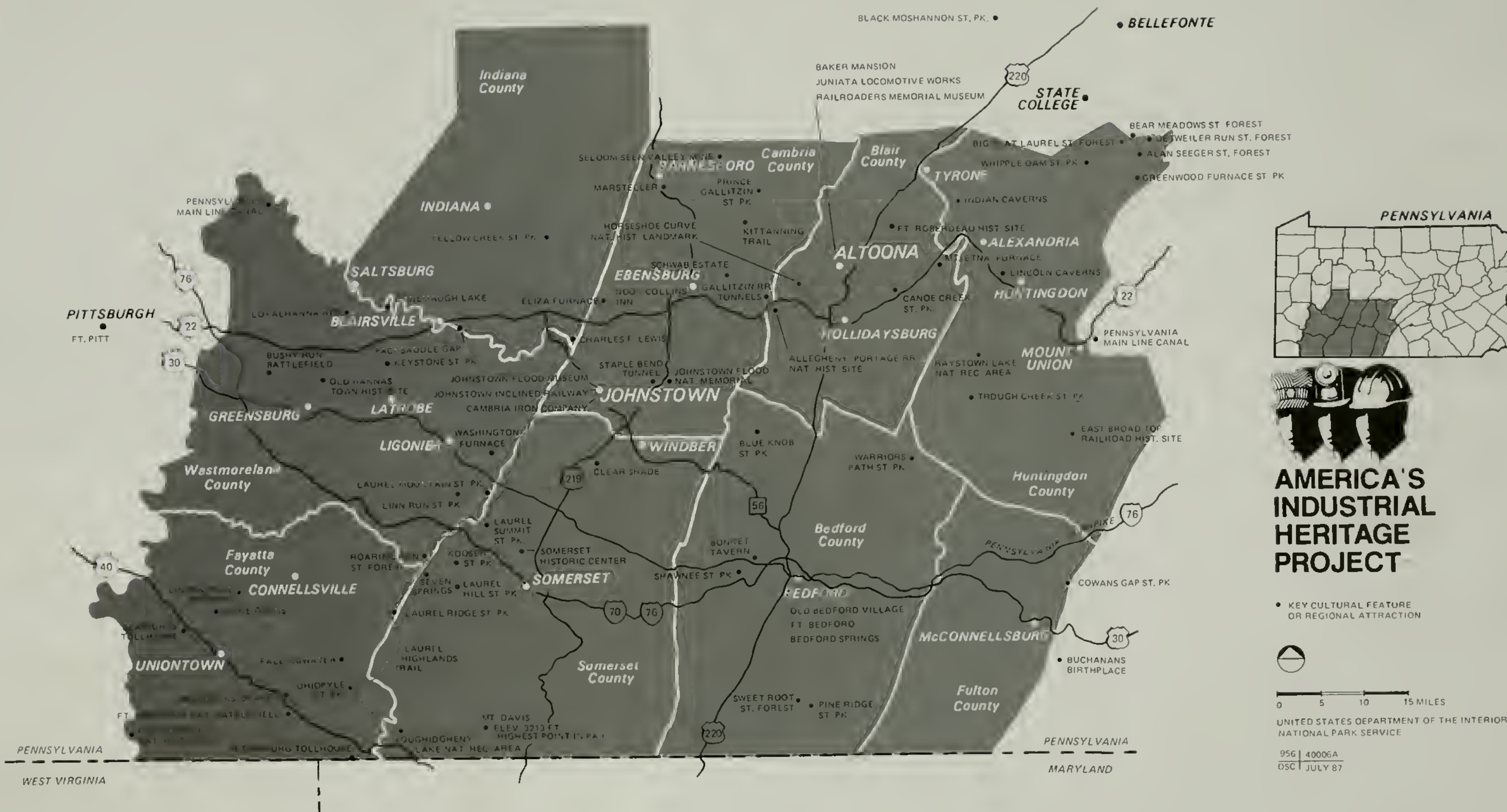

AMERICA'S INDUSTRIAL HERITAGE PROJECT
PENNSYLVANIA
KEY CULTURAL FEATURE OR REGIONAL ATTRACTION
0 5 10 15 MILES
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
956 | 40006A
DSC | JULY 87
Indiana County
Cambria County
Blair County
Huntingdon County
Bedford County
Fulton County
Somerset County
Fayatte County
Wastmoreland County
INDIANA
SALTSBURG
BLAIRSVILLE
PITTSBURGH
FT. PITT
GREENSBURG
LATROBE
LIGONIER
CONNELLSVILLE
UNIONTOWN
EBENSBURG
JOHNSTOWN
WINDBER
SOMERSET
ALTOONA
TYRONE
ALEXANDRIA
HUNTINGDON
HOLLIDAYSBURG
MOUNT UNION
BEDFORD
McCONNELLSBURG
STATE COLLEGE
BELLEFONTE
BLACK MOSHANNON ST. PK.
BAKER MANSION
JUNIATA LOCOMOTIVE WORKS
RAILROADERS MEMORIAL MUSEUM
BEAR MEADOWS ST. FOREST
ALAN SEEGER ST. FOREST
GREENWOOD FURNACE ST. PK
WHIPPLE DAM ST. PK
INDIAN CAVERNS
LINCOLN CAVERNS
CANOE CREEK ST. PK.
PENNSYLVANIA MAIN LINE CANAL
RAYSTOWN LAKE NAT REC AREA
TROUGH CREEK ST. PK
EAST BROAD TOP RAILROAD HIST. SITE
WARRIORS PATH ST. PK
COWANS GAP ST. PK
BUCHANANS BIRTHPLACE
OLD BEDFORD VILLAGE
FT. BEDFORD
BEDFORD SPRINGS
SWEET ROOT ST. FOREST
PINE RIDGE ST. PK
SHAWNEE ST. PK
BLUE KNOB ST. PK
ALLEGHENY PORTAGE RR NAT HIST SITE
JOHNSTOWN FLOOD NAT. MEMORIAL
STAPLE BEND TUNNEL
JOHNSTOWN FLOOD MUSEUM
JOHNSTOWN INCLINED RAILWAY
CAMBRIA IRON COMPANY
GALLITZIN RR TUNNELS
SCHWAB ESTATE
HORSESHOE CURVE NAT. HIST. LANDMARK
KITTANNING TRAIL
PRINCE GALLITZIN ST. PK
MARSTELLER
YELLOW CREEK ST. PK.
ELIZA FURNACE
CHARLES F. LEWIS
WASHINGTON FURNACE
KEYSTONE ST. PK
BUSHY RUN BATTLEFIELD
LAUREL MOUNTAIN ST. PK
LINN RUN ST. PK
LAUREL SUMMIT ST. PK
SOMERSET HISTORIC CENTER
KOOSER ST. PK
SEVEN SPRINGS
LAUREL HILL ST. PK
LAUREL RIDGE ST. PK
LAUREL HIGHLANDS TRAIL
CLEAR SHADE
MT. DAVIS ELEV. 3213 FT HIGHEST POINT IN PA.
YOUGHIOGHENY LAKE NAT. REC. AREA
OHIOPYLE ST. PK
FALLINGWATER
PENNSYLVANIA
WEST VIRGINIA
MARYLAND
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INTRODUCTION

They are the man-made dinosaurs of our nation's past, these remnants of the industrial revolution's marvels – the factories, canals, bridges, and railroads that grew continually larger and more complex between the 1750s and the 1950s. In 1987, a grass roots effort to preserve and interpret them was given a focus and a name by the National Park Service: the America's Industrial Heritage Project (AIHP).

Centered in southwestern Pennsylvania, the AIHP embraces components that tell the story of transportation, and of the iron, steel, and coal industries in the United States: early roads, canals, and railroads; tunnels and bridges; an inclined plane for transporting sectional canal boats over the Allegheny Mountains; mines and quarries; and factories of all sorts. Also here, and equally essential to the story of life and work in those times, are the houses of the factory workers and owners, together with the businesses, churches, and clubs they patronized.

The National Park Service envisions a network of sites, coordinated by locally formed commissions, that will illustrate the advent, rise, consolidation, and decline of these heavy industries. Some of the sites are already recognized as historic. Among these are the Johnstown Flood National Monument, the Friendship Hill National Historic Site (the Albert Gallatin estate), the Allegheny Portage Railroad National Historic Site, the Pennsylvania Main Line, the Staple Bend Railroad Tunnel, the Charles Schwab Estate, the Mount Etna Furnace, and the Cambria Iron Works. Several of the sites are in the national park system, some are state historic sites, and others are administered by local governments or private organizations. To interconnect these sites, roads are being improved, thematically linked tour routes are being developed, wayside displays are being installed, and railroad excursions and hiking trails are planned. Additionally, a public information program, including on-site interpretation and special events, will promote the sites not just as individual units but also as parts of a cohesive story.

The beginnings of this effort have been encouraging, but many of the current or potential sites of the AIHP present difficulties not usually encountered at historical parks. During the two centuries that began in the 1750s, economies of scale were progressively recognized and acted on, resulting in ever larger buildings, machinery, and labor forces. As a consequence, the material remains that reflect the rise of heavy industry in the United States are massive, and their preservation and interpretation are extremely complex tasks. The AIHP, in this regard, might best be viewed as an archeological undertaking of unprecedented scope.

The huge artifacts from industrial sites are notoriously expensive to conserve and store, and highly dependent on context for both maintenance and interpretation. To start planning for the proper treatment of these artifacts, which clearly must be one of the AIHP's fundamental objectives, an advisory panel of 28 specialists – archeologists, historians, museum directors and curators, historical architects, and conservators – was established to develop recommendations. Organizations represented on the panel include the Smithsonian Institution, the Henry Ford Museum, the Society for Industrial Archeology, several universities, and a number of historical organizations in Pennsylvania. The members of the panel and their institutional affiliation are listed in the final section of this document.

Recommendations of the panel will help determine what should be saved, and how, and will guide the interpretation of this material. Decisions must be made quickly. These industrial sites, largely rooted in the 19th century, were part of an economic infrastructure that is now obsolete, and obsolescence, in economic terms, has transformed the buildings and machinery at these sites into liabilities rather than assets.

The AIHP represents an opportunity to preserve fundamental elements of the material culture of an era that produced most of today's social, technological, economic, and political realities. The artifacts directly associated with industrial production – the buildings, machinery, furnishings, graffiti, and documents – as well as the material reflection of the social system – the houses, churches, clubs, union halls, restaurants, and bars – all still exist. If efforts to preserve them are not begun now, however, these invaluable artifacts will be irretrievably lost.

PRIMARY ISSUES CONSIDERED

I. INVENTORYING HISTORIC INDUSTRIAL SITES

The preservation of industrial heritage sites and artifacts is an important mission for those wishing to document our common national experience. Industrial preservation has nonetheless developed more slowly than other elements of the preservation movement – the preservation of homes for example – and despite growing public concern, the United States still lags behind some European nations in this area. Distasteful socioeconomic associations, perceptions that industrial structures lack aesthetic merit, and the realization that industrial preservation could prove overwhelmingly difficult, have all hindered the field's development.

Historically, individual large industrial artifacts have been preserved haphazardly, an engine saved here, a quaint mill there. Pioneering efforts, such as those of Henry Ford or the

Smithsonian in the early 20th century, tended to concentrate on individual artifacts, and some museums have limited themselves to particular industries, such as textile manufacturing. The industrial buildings that have been saved, most often through the efforts of local groups, have been selected as much by chance as anything else. The National Park Service has concentrated on documenting important sites, although funding has been limited. Few efforts have been made to preserve contexts along with the industrial artifacts. The diversity of past approaches, as well as the complexity of the problem, suggests that cooperative efforts, such as those that resulted in the establishment of Lowell National Historical Park in Massachusetts in 1978, represent the way of the future.

The absence of an overall plan for industrial preservation, however, one that provides the rationale for the selection of particular artifacts, buildings, and complexes to be preserved, makes even cooperative efforts exceptionally difficult. In this situation, it is not surprising that creatively engineered structures are torn down as their economic utility fades, that unique machines are scraped, that historically significant buildings are burned by vandals, that in sum our national industrial heritage is rapidly slipping away.

Inventorying industrial resources, to document them and aid in the evaluation of their historical significance, is obviously among the most important steps in the preservation process. Yet only a very small fraction of industrial sites will ever be preserved, and in most cases the written and graphic record will become the only evidence of them and of their historical role. Inventories have an essential contribution to make in that regard as well. Two interrelated types or stages of inventory – macro and micro – are needed. The macro inventory would permit the development of a national data bank containing information about important industrial complexes. The characteristics of significant artifacts at these sites would be recorded in the micro inventory. The objectives, intensity, and other characteristics of both types of inventories would depend largely on whether or not the sites are still operating, on the likelihood of their preservation, on their historical significance, and on the availability of resources, especially funding. It is quite likely that elements of both will often be pursued at the same time.

THE MACRO INVENTORY OF SITES

As models for the macro inventory which the AIHP needs, the industrial surveys currently prepared by the National Park Service's Historic American Buildings Survey / Historic American Engineering Record (HABS/HAER) are very helpful, but they are not detailed or precise enough for full determinations of historical significance, or, in the event that a site and its artifacts cannot be preserved, for completely satisfactory historical documentation. The AIHP macro inventory will need to provide for the listing of all significant structures within the sites, and of their sizes and types of construction. Archeological remains and significant internal elements will also need to be noted. The internal elements might range from major machinery – a blast furnace or rolling mill engine – to items of importance for labor history – a locker room, employee recreational facilities, or even outstanding labor graffiti. It is imperative that industrial **processes** be recorded, along with the mechanical and other **systems** (e.g., HVAC and communications) associated with them, and not just the individual structures and machines.

The macro inventory would, in many respects, be similar to Cultural or Ethnographic Site Inventories, as described in the National Park Service's *Cultural Resources Management Guidelines*, and should provide all the information needed for the nomination of sites to the National Register of Historic Places, if their significance and other circumstances warrant it. The point, obviously, is not simply to collect the information, but to construct a data bank, accessible to museums and other partners in the effort, that can serve as a basis for management decisions.

Much work toward establishing a macro inventory has already been done by HABS/HAER, and that office should continue to provide guidance, including the development of specific reporting formats to assure uniformity and compara- bility. However, with its limited resources, that office cannot possibly implement the entire job, on a national scale, by itself. Local museums, historical societies, and professional organizations must become active partners in the effort, and industry itself must be involved. People within a specific industry often know precisely where historically important artifacts are.

If the industrial plant being inventoried is still active (and presuming that the owner's permission can be secured, not always an easy task), graphic documentation – photographs, video (and/or sound) recordings, drawings if they do not already exist – would be essential, as would interviews with key personnel. Remember, the objective would be to record the LIVING plant and process, not to create an image of a dead body. Among the side benefits of the macro inventory would be the increased awareness of owners and workers regarding the historical significance of these sites. With the inventory, when it becomes evident that a site or some parts of it should be preserved, the owners could be alerted far enough in advance to prevent inadvertent, last-minute losses of key site components. It is unreasonable to wait until an owner has decided on demolition before rushing in to try to stop it. If an owner knows in advance that various structures or artifacts are worth saving as part of the nation's industrial heritage, he or she may make the effort to do so.

Even when a site being inventoried has been abandoned for some time, it is important to establish a graphic record of its existing conditions, as well as to reconstruct how it operated before abandonment. For the latter goal, interviews with former employees, and if possible a tour of the plant with them, would be of critical importance. Historical research would be essential as well, partly as a check against faulty recollections. It would be important also to document any earlier uses of the plant and the sequence of modifications.

THE MICRO INVENTORY OF ARTIFACTS

With micro inventorying, a specific site would be investigated to document the location, condition, and other characteristics of significant artifacts within that site. Considering the sizes of many industrial sites, this phase of the process could be laborious indeed. Imagine, for example, a complete inventory of the Ford's Rouge River Plant. While a complete micro would be essential for the preservation management of industrial artifacts, it should only be done once the site's significance has been recognized. In some ways the micro inventory would be like the registration stage of museum cataloging, and should be designed to complement that process, discussed in section II.

The selection of artifacts, and attributes, to be recorded will depend on careful determination beforehand of the criteria to be applied. Nameplate data (manufacturers, serial numbers, patent dates, etc.) from critical components are especially important, as, once again, are the systematic interrelationships among components. Engineering drawings, photographs, and other records should be documented, and whenever possible, actually collected. Bear in mind that interpretation of an entire industry by means of a single machine in a static display would be like trying to build an exhibit on farming using a stuffed cow as the major artifact.

To document the work experience, many of the small things that give a place HUMAN dimensions will need to be recorded, and where possible preserved – work clothes, employee recreational facilities, union materials, and locker rooms. At still operating plants, it is important to remember that some of most moving artifacts are the first to disappear. For example, when the Cayahoga Lamp Works of the General Electric Company closed a few years ago, the plant had all sorts of morale-boosting signs. Those with graffiti scrawled on them (e.g., "Thanks for Giving Us the Boot") quickly vanished, and with them went much of the physical evidence for the sense of despair of workers soon to be out of a job.

A major outcome of the inventories will be production of a well-supported historical document that describes how the plant originally functioned and what its historical and social significance was. In addition, it will be a record of the physical appearance of the plant at the time it is inventoried, something of inestimable value in its own right should preservation prove impossible.

IMPLEMENTING THE INVENTORIES

Implementation of the inventories requires the following actions:

> A consortium of interested parties must be established to provide direction. It would include representatives from museums, the National Park Service, and HABS/HAER, as well as academic and other professional societies (SIA, SHOT, SCA, ASCE, ASME, IEEE, SME). Again, industry must also be included, and hobbyists within the industrial collecting field, who often know of threatened sites well ahead of everyone else, should not be overlooked.
>
> Criteria must be established to define the parts of the industrial infrastructure to be documented and saved. Sites must be measured against a national yardstick of significance, so that limited funds can be properly allocated. There is no point in extensively inventorying sites that have little significance. The inventory panel must ultimately function like a museum's collections committee.
>
> Industrial documentation must also be preserved, including such materials as corporate records, engineering records, films, and photographs. This work should be undertaken in cooperation with an established archive to ensure that as many of these materials as possible are saved.
>
> A central office must be established to act as a repository for the gathered information, either at HABS/HAER or separately. A data base needs to be established so that interested people can get the information they want quickly. In today's computerized world this should not

be a problem. Adequate funding, however, must be found to support the effort.

Newsletters of existing organizations should be explored as a means of getting information out, as should the potential of a computer bulletin board. Interested parties will need to be quickly notified when inventoried sites or artifacts become available or threatened.

Establishing guidelines for determining which sites should be inventoried, and beyond that which are worth saving, will be difficult. There is a natural tendency for preservation support to be distinctly local in nature. People in one city may be enthusiastic about preserving a mill in that city, but they may have little or no interest in saving a more significant one elsewhere. Extreme selectivity, combined with a national overview offered by the reviewing committee, is the only way representative sites would be documented and preserved nationwide.

The inventorying process, which is ultimately a process of selection, emerges as a key element of the overall preservation scheme. Great care must be taken to see that wherever possible the right sites – the best sites – are documented and preserved. It is imperative that these essential components of our national heritage survive, in our consciousness and, insofar as possible, within our built environment.

II. CURATING LARGE INDUSTRIAL ARTIFACTS

CLASSIFYING INDUSTRIAL ARTIFACTS AND STRUCTURES

Industrial artifacts constitute a broad range of movable and immovable objects, made from a wide variety of materials. The curation of such a diverse array of objects, their day-to-day management, begins with the decision that they be treated as parts of a museum collection, one outcome of the inventory process described in section I.

Traditionally, by NPS guidelines and historic preservation standards, immovable objects have been regarded as structures, and accordingly recorded and managed separate from collections. However, the procedures and forms for classifying and documenting structures (e.g., List of Classified Structures procedures) are not entirely satisfactory for use with large industrial artifacts. Recognizing this problem, recent developments in collection cataloging and management, in particular the Automated National Catalog System (ANCS), and *The Revised Nomenclature for Museum Cataloging*, allow for the detailed documentation of buildings, other structures, and immovable pieces of equipment as integral elements of collections.

Some historians and curators would classify industrial artifacts into four basic categories:

> Buildings and large structures, including things such as mill buildings, blast furnaces, coke ovens, water towers, smoke stacks, cooling towers, and catalytic cracking units.
>
> Machines, including turbines, blowers, generators, motors, forging hammers, stamping machines, rolling mills, overhead cranes, charging machines, and furnaces. In context, these usually were surrounded by some sort of enclosure. This category would also include large mobile equipment like draglines, offroad dump trucks, and straddle carriers.
>
> Defined areas within buildings, including locker rooms, control rooms, and offices. However, if these are freestanding, they would fall into the first category.
>
> Tools and miscellaneous equipment, including tongs, lunch pails, and safety helmets. These smaller artifacts would be collected along with the others because they are indispensable for conveying the complete industrial story.

RECORD-KEEPING FOR INDUSTRIAL ARTIFACTS

But whatever the classification scheme and descriptive procedures, and their automated implementation, the accessioning and cataloging of industrial artifacts will be successful only if terminology is standardized. Adherence to the *Nomenclature* system is the most reasonable approach to take in this regard, together with the use of the National Park Service's *Museum Handbook, Part II, Museum Records*, and the ANCS. Modifications could be made as needed. Documentary materials such as photographs, architectural and engineering drawings, videotapes, and sound recordings would be accessioned, cataloged, and archived in accordance with similar standards, and cross-referenced to artifact records.

Decisions concerning the preservation of ancillary structures and equipment must be made at the beginning of the process, ideally during the micro inventory, outlined in section I. Should only the main equipment of a rolling mill, such as a mill stand and horizontal steam engine, be preserved? Or should the surrounding building, offices, pulpit, locker room, cranes, reheating furnaces, and inspection and shipping areas be collected, possibly dismantled, and preserved as well? While it certainly would not be possible to preserve entire processes very frequently, an attempt must be made, where appropriate, to preserve as many supporting structures and as much equipment as possible, so that the context of actual use remains available for study and interpretation. Again, as noted previously, selectivity is the key. It may be feasible to curate the ancillary equipment of a single important artifact, while storing other similar artifacts without their peripheral equipment and structures.

It is especially important that records for industrial artifacts identify their construction or fabrication materials, and indicate their locations and present conditions. Obviously, periodic inspections to determine and record the conditions of artifacts will also be necessary.

STORING INDUSTRIAL ARTIFACTS

The minimum storage requirements for most large industrial artifacts should aim at protecting them from driving wind and rain. Indoor storage of such artifacts is always preferable to outdoor storage. Even with the best maintenance out-of-doors, deterioration is inevitably more rapid. The storage area should be secure, and artifacts should rest on blocks or pallets to prevent contact with damp floors. It should be recognized, however, that museum quality storage specifications may not be feasible for larger manufacturing equipment that is to remain *in situ* within existing unheated industrial buildings. In many cases, the costs of sealing, heating, and air-conditioning such buildings would be prohibitive.

If artifacts in storage are to be labeled or tagged, the placement of these identifiers will need to be consistent, and the methods and materials used should be waterproof.

The application of curatorial standards to the storage of smaller, fragile, or environmentally sensitive objects would also depend on funding. Areas within larger, environmentally uncontrolled buildings could be isolated and controlled to museum-quality conditions. One method of isolating space is to use special prefabricated, free-standing buildings inserted into existing structures. Each unit is constructed from modular panels of sheet steel with an insulating foam core. The modular construction permits easy assembly, enlargements, and disassembly. The temperature and relative humidity within each module may be tailored to meet the requirements of the collections.

The National Park Service, the American Association of Museums, and the Smithsonian Institution have all developed guidelines for the preservation and protection of museum collections. These guidelines, summarized below, constitute the basic, professionally accepted requirements for curating and managing collections. Although they were developed for more portable objects, their applicability to large, immovable equipment must also be given due consideration.

Space

Safe and secure storage of museum collections generally requires dedicated, suitable, and sufficient space. Closets, unimproved basements, and outbuildings are rarely acceptable spaces for the preservation and effective use of a collection. Museum storage areas should be used only for museum collections. Storage should be separated from all other uses, including office space, as well as work and research areas.

The space selected for museum storage should be adequate for the quantity and particular shapes of objects. This requirement would be particularly true for industrial collections. Adequate space must be provided so that stacking objects or boxes of objects can be avoided. Finally, space should be organized to allow for the efficient use of curatorial equipment and for effective access to the collection.

Packing materials

Objects should be housed in appropriate containers and with appropriate materials. Wrapping and padding materials need to be archival-quality and chemically stable. Full-scale mothballing, using vapor phase inhibitors or vacuum wrap systems, are options for storing some large metal artifacts typically found in industrial collections. Such systems may cause as many problems as they solve, however. They can be very expensive, and desiccants used with vacuum wraps must be monitored and replenished when exhausted. Both systems make artifacts less accessible to the public and staff.

A stable museum environment

Museum objects need to be curated in a safe, stable environment to reduce their rates of deterioration, prolong their lives, and minimize their needs for costly conservation treatments. The five major factors to be controlled to create a suitable environment are temperature, relative humidity, visible light, ultraviolet light, and pollutants.

> *Temperature.* Lower temperatures are favored for collections because the rates of chemical reactions and biological activities increase as the temperature increases. Temperature is monitored continually and controlled to minimize fluctuation and to avoid harmful extremes. The upper limit should not exceed 24°C (75°F). In

exhibit and storage spaces where the comfort of people is a factor, the recommended levels for temperature are 18-20°C (64-68°F). Where human comfort is not a factor, the temperatures may be allowed to fall to just above freezing, provided that the level of relative humidity does not trigger condensation on cold surfaces. This phenomenon could occur on large metal artifacts stored in unheated buildings.

Relative humidity. Relative humidity (RH) is the most important factor to control, although often in historic buildings also the most difficult. RH must be monitored and maintained to avoid wide fluctuations and extreme levels. Maximum and minimum levels are determined by the kinds of artifacts in the collection: organic artifacts require a level of 55-60% RH; levels above 65% RH encourage the growth of mold. Metals require a drier level of 30-40% RH, to reduce corrosion. Ideally, fluctuations should not exceed ± 3% RH per month.

Visible light. Elevated levels of visible light produce heat, which in turn can stimulate chemical reactions, as well as desiccate organic materials. The intensity and duration of the exposure of objects, especially organic objects, to the visible spectrum should be limited, and daily and seasonal variations of light should be monitored. Light sensitive artifacts, including dyed textiles, paper, watercolors, manuscripts, and leather, should not be exposed to light higher than 50 lux (5 footcandles). Undyed and untreated organic materials, oil paintings, and tempera paintings may be exposed to levels no higher than 150 lux (15 footcandles). Metals, ceramics, and glass are generally insensitive and may be exposed to higher light levels, up to 300 lux (30 footcandles). Collections of mixed materials should be stored according to the most sensitive material.

Ultraviolet (UV) light. UV radiation stimulates photochemical degradation of organic materials and painted surfaces. All forms of lighting used in museums, including daylight, fluorescent, tungsten, and tungsten-halogen lamps, emit UV radiation. If the UV radiation exceeds 75 microwatts/lumen, the level must be controlled by installing a filtering material between the light source and the museum artifacts. Options for filters include plastic solar film for windows, plastic filter sleeves for fluorescent tubes, and acrylic sheeting with incorporated screening. Filtering devices must be periodically monitored to ensure their effectiveness.

Pollutants. Museum storage and exhibit areas should be free of particular and gaseous pollutants. Charcoal and fibrous filters may be installed in HVAC systems to remove contaminants. Controlling pollution would be a factor in regions with on-going industrial activity.

Security, fire protection, and emergency collection removal

Museum storage and exhibit areas need to be physically secure, through the use of appropriate locks, barriers, alarms, and surveillance equipment. Access and keys should be controlled. Systems should be installed in curatorial areas for detection and suppression of fire. Two common extinguishing systems are water and halon gas. Structures and internal modifications should be fire-resistant, to the extent possible, given the nature of the historic building. A program for responding to unforeseen disasters like fire and flood should be established. The logistics of moving a collection quickly in an emergency should be well considered. This requirement is especially important for industrial sites on floodplains.

Housekeeping

A housekeeping program for exhibit and storage areas needs to include regular inspections for evidence of insect and other biological infestations. Environmental monitoring equipment, and security and fire detection systems, must be checked and maintained, shelves and cabinets must be dusted, floors mopped and vacuumed, and trash disposed of. Written job responsibilities, among other features, characterize a well-prepared housekeeping program.

REGIONAL VS. CENTRALIZED REPOSITORIES

One of the major, as yet unresolved issues concerning the curation of industrial artifacts is the appropriate geographical scope of curatorial facilities. Many historians and curators of industrial collections feel that regional curatorial facilities would be superior to one or two centralized facilities. The costs for transporting artifacts to and from central repositories would be prohibitive, and the amount of space needed would be enormous. In addition, regional centers would very likely be more accessible to most people than a central facility.

Interpretation would also tend be more difficult for a centralized curatorial facility, due to the removal of artifacts from their contexts. An interpretive context could be more easily developed at a regional facility, since even though artifacts there would also have been removed from their original contexts, they would still remain within the region or area where they had greatest social and historical significance. Again, contexts need to be documented as fully as possible, using photographs, measured drawings, videotapes, and sound recordings. The issues of interpretation and context are discussed in sections IV and V.

THE ORGANIZATION OF INDUSTRIAL COLLECTIONS

There are at least three ways whereby artifacts could be grouped in regional storage. One approach would be by specific industry – for example, all artifacts related to the steel industry would be located at a particular site. For this to be feasible, some facilities would need to encompass broader industrial categories, such as transportation, due to the impossibility of creating regional repositories for each smaller industry. This approach would also simplify agreement on the collection focus of individual facilities, since none would need to acquire a representative sampling of the whole of American industry.

A second approach might be to establish repositories based on the functions of artifacts. For example, all steam engines, regardless of the industries in which they were used, could be housed together. This would be helpful in interpreting the operation of particular categories of artifacts, but it would also destroy contexts.

A third approach could emphasize geography, but since many industries are or were specific to particular regions of the country, it could incorporate aspects of the first approach. Repositories could still be devoted to the collection and preservation of artifacts in the regions where they are located, grouped according to the historically significant industries. This geographic approach offers the greatest possibilities for creating industrial sites that would present meaningful and comprehensible experiences for visitors. By this means, the histories of the regions in which the facilities are located, rather than merely the artifacts of a particular industry or particular types of machinery, would be interpreted.

Perhaps the most important advantage of the regional approach would be the opportunity to use space at historically significant industrial sites, thereby partially justifying the saving of related buildings. This may be the only way that some very massive contextual elements representative of industry could preserved. Using industrial sites also could mean that cranes, internal rail networks, and other equipment would be available for handling the artifacts (see section III).

Because of the difficulties in moving and displaying large industrial artifacts, local museums would be limited in the capability of displaying the artifacts stored in a regional facility. Since the facility would very likely become the permanent home for much of the collection stored there, serious consideration should be given to an open-storage arrangement that would allow visitors to view the collection.

III. CONSERVING LARGE INDUSTRIAL ARTIFACTS

A DIFFERENT PERSPECTIVE

Conservation involves the preservation and stabilization of historic objects, and aims most fundamentally at the prevention of further deterioration. This approach differs from restoration in its belief that information an artifact embodies can be as important as its appearance. Restoration often entails a major effort to return artifacts to their original appearance and condition. But in making artifacts look as good as new, restorations sometimes disrupt or overlook important documentary evidence, such as paint layers, patch repairs, and wear marks. While the "restored" machinery may appear to be in pristine condition, information about its operation and modifications may have been lost.

Yet each approach to the preservation of industrial artifacts, such as rolling mills, lathes, and drop hammers, has merit. There are, rightly, many kinds and levels of preservation. In some situations, preservation can consist of restoring machinery to actual operating condition. Many industrial historians and curators believe this is the only legitimate way to preserve industrial artifacts, with or without cosmetic makeovers. But even if nothing is done but safeguarding machinery from vandalism and destruction, a type of preservation is accomplished. Above all, it must be recognized that not all machinery has equal significance, and that limited resources do not permit saving, let alone conserving, everything.

It is essential that each piece of machinery being considered for preservation first be evaluated by curators, industrial historians, and conservators. In addition to determining the machinery's historical and technological significance, this joint evaluation would serve to determine its likely rarity or uniqueness.

How an artifact is to be used as part of a collection or exhibit is also important. Certain questions need to be answered before any plan can be implemented. Could or should a machine be made operational? Would it be safe or cost-effective? Would it serve as the focal point and a "draw" for visitors to an exhibit or interpretive center? Or could it be preserved without running, perhaps by simulating operation through sophisticated exhibit design? Should a treatment be purely cosmetic? Should the machinery be static? Are other pieces of equipment needed for interpretation of a complete process available?

Often, the extent of conservation or restoration will be largely dictated by the setting. An artifact left indoors in an unheated building is unlikely to receive the pampering typical of mechanical objects in museums, which are exhibited and maintained under more controlled levels of temperature, relative humidity, and light. This lack of environmental control after treatment will affect the choices of techniques and materials for conservation. Under the circumstances it would be difficult to truly stabilize the artifact. Nevertheless, even without a controlled climate, indoor storage and exhibits are preferable to outdoor ones. If outdoor storage and display are the only choices, more permanent and weather-resistant coatings would in most cases be required.

Efforts to preserve large industrial artifacts differ from the conservation of mechanical objects like clocks, musical instruments, and vehicles commonly found in museum settings. First is the problem of scale. The sheer sizes of industrial artifacts make treatments lengthy, labor-intensive, and costly. Many pieces are immovable. Some equipment may have been built into factories or mills that are now regarded as historically significant. These objects are not readily transported to new facilities without dismantling and possibly damaging the equipment. Indeed, many industrial historians now feel that these large pieces lose significance if removed from their original contexts. The importance of preserving the industrial landscape is presented in section V. In addition, as outlined below, the conservation of large industrial artifacts requires special skills, equipment, and technology not common in other branches of conservation. These requirements hold true whether the artifacts remain in their contexts or are removed to museums or other exhibit facilities.

THE CAPABILITIES OF THE CONSERVATOR

Conservation of an industrial artifact first requires a sensitivity to the object's tangible and intangible qualities. Conservators must be knowledgeable about the history and techniques of manufacturing, how the equipment operated, and what it looked like in use. They must also be familiar with the kinds of materials applied to or used with the artifacts, such as historic paints, greases, and lubricants. Before starting treatment, they must consult with the curator, park administrator, and historian to weigh the options available, and must carefully consider any intervention into the condition or appearance of the artifact. Safety factors must be considered as well, especially at once-active, chemical-related sites.

Conservators must understand the chemical and physical mechanisms of corrosion and deterioration, and should be able to distinguish between active corrosion and more stable crusts. They should also be familiar with the modern materials used in treatments, like undercoat, paint and lacquer systems, and the compatibility of these with materials such as greases and oils.

Finally, the American Institute for Conservation's Code of Ethics and Standards of Practice should be followed. Central to this code is the concept of a treatment's reversibility: it should be possible to undo in the future, if necessary, what is done during treatment. Because of the scale and problems presented by industrial artifacts, often reversibility must be compromised. However, stabilizing the artifacts and preserving the information they contain remain the predominant factors.

IMPORTANCE OF DOCUMENTATION

Before treatment begins, thorough documentation of an artifact is necessary. While documentary photographs and diagrams are required in all kinds of conservation treatments, industrial artifacts might need more specialized documentation. Original photographs and line drawings, if extant, are useful for determining historic appearance. Interviews with individuals who operated and maintained the machines are an invaluable record. Videotapes of equipment in use can provide information concerning the contemporary operation of machinery. A series of exploded diagrams may be required in dismantling artifacts; again, videotaping during disassembly is another option. Finally, in some special cases, examination using X-ray or ultrasound may be necessary to locate stress cracks, old repairs, and modifications.

NEEDED FACILITIES AND SUPPORT SERVICES

Whether large industrial artifacts are treated *in situ* or removed to a laboratory or shop setting, equipment such as hoists, overhead tracks, gantries, mini-cranes, and elevated platforms will be required. Rail access might also be useful. Much of this equipment may exist or be adaptable at a historic mill site, and its availability could determine whether or not an area might be used for conservation activities. The floor of the space might well need to be reinforced. Artificial and natural lighting in an exiting mill structure would very likely need to be improved, along with the heating and ventilating system, the electrical supply, and the plumbing.

For *in situ* treatments, a "room within a room" would, in some cases, need to be temporarily constructed for isolating operations such as sandblasting, water or air peening, or spraying. *In situ* treatments would also require improved lighting and ventilation.

A well-equipped machine shop is the most important support service for the conservation of industrial artifacts. The specialized skills needed would include arc welding and retooling of parts, and a conservator would need to review work in progress. If machines are to be operated, then technicians must be trained in running and maintaining the equipment; again, it is important to draw from the recollections of actual operators.

SAFETY CONSIDERATIONS

It should be noted that both modern and historic toxic materials are likely to be encountered in treatments. Asbestos is a common historic contaminant. In any such situation, protective clothing and equipment that meet Occupational Safety and Health Administration standards must be used.

There is no single, correct conservation treatment for industrial artifacts. Instead, conservators tailor treatments to individual artifacts, using combinations of techniques ranging from complete intervention like dismantling to total passivity. As pointed out above, the selection of treatment is based on the use of the artifact (operational vs. static) and the setting (indoor vs. outdoor). Reversibility, extent of corrosion, cost, and availability of equipment and materials are other factors.

CLEANING AND STABILIZATION TECHNIQUES

Common industrial systems for cleaning, preparing, and coating surfaces of iron and steel involve the uses of sandblasters and/or solvents followed by alkyd, coal-tar, vinyl, phenolic, or oil-based paints. However, because conservation treatments should be reversible, many rust treatments (like baked enamel) used in modern industrial applications are not suitable for historic machinery. The use of modern anticorrosion systems on artifacts which, during their lifetimes, would have never been treated with these products remains controversial, but less permanent treatments eventually must be performed again, and every intervention changes the nature of the artifact.

Methods for removing scale and rust include micro-peeners using fine abrasives or walnut shells, steam and water jets, and fine pneumatic pens. These methods are generally preferred by conservators over chemical and acidic reagents, which are generally more damaging and difficult to control.

Undercoatings used in conservation include organic, solvent-based slushing compounds and dewatering fluids as well as tannic and phosphoric acids. The latter lay down insoluble, passivating layers of iron tannate and phosphate. Zinc chromate, common in outdoor applications, is rarely used in treating historic artifacts. Silicone appears promising but has not been thoroughly tested. Research in the performance of undercoatings currently is underway at the Canadian Conservation Institute in Ottawa.

Protective topcoats should be compatible with the undercoating. Acrylic lacquers, as well as microcrystalline and/or polyethylene waxes, have been used to coat surfaces, but they are not long lasting, except in the controlled indoor environments of museums. Epoxy systems and metallic-loaded paints are alternatives for outdoor use.

Special consideration must be given to old paint layers. The layers need to be removed selectively by solvents or abrasives. For large industrial artifacts, this kind of treatment can be laborious, but liquid nitrogen has been used to lift large surface areas of paint more quickly. If the paint is to be preserved, it may be lightly peened just to remove dirt and light rust. In some instances, underlying rust may be treated chemically through a disrupted paint surface. Conversely, an artifact can be completely repainted by selecting a coating of different solubility from the historic paint layers to preserve these layers while enhancing the overall appearance of the artifact.

ALTERNATIVES TO CONSERVATION

Any program for conserving large industrial artifacts will undoubtedly involve different types of preservation: full-scale restoration, cosmetic make-overs, mechanical operation, and passive storage. It will also require different types of facilities, and the capability of providing *in situ* conservation, since there are many large industrial artifacts which it would be impossible to móve. It is unlikely that costly and time-consuming conservation will be appropriate for every piece of equipment. And, as explained above, conservation technology is not without flaws or hazards. As discussed in section II, much can be done, and probably more effectively, by creating decent environments for storing and displaying equipment and artifacts.

IV. INTERPRETING AMERICA'S INDUSTRIAL HERITAGE

America's industrial heritage can only be interpreted through a variety of sites and experiences, since no one site can tell the whole story. Each kind of site is distinctive and must be seen as part of an integrated network. Even within this basic approach, however, there several alternatives.

NATIONAL CENTERS

National centers for interpreting specific industries can be justified on the basis of their cost-effectiveness and greater accessibility to visitors. A few large sites would probably require less staff than many smaller units, and each one would provide visitors with a major destination. Given the monumental costs of preserving industrial sites, proliferation of similar sites should be avoided.

The interpretive programs developed for a large site could provide a multilayered representation of an industry. The site's history could be placed within a broader regional or national context, while corporate and technological changes in the industry could be interpreted together with its social dimensions. The impact on visitors would be more profound.

REGIONAL CENTERS

Regional centers might be more successful than one or two national centers for interpreting such industries as iron and steel making. Regional centers would assist communities in retaining links to their pasts, and access by the local population would be easier. A sense of the geographic distribution of industry would be maintained. Finally, large industrial artifacts would be more easily transported to a centralized regional center.

Another option consists of satellite units, or scattered sites linked together in a system. The physical scale of such sites might prove less overwhelming to visitors, and the experience of traveling among the sites in a regional network could provide visitors with a deeper understanding of the influence of local geography on decisions made by industrialists in the past. Satellite units could also permit better expositions of specific technological changes, and of regional variation, in an industry.

SATELLITE UNITS

In addition, satellite units would be extremely beneficial to the interpretation of local culture. A network of these units could provide visitors with unique, and contrasting, site experiences. As appropriate, interpretive programs and exhibits would be coordinated on both regional and national levels.

Because the iron and steel industry has always depended on networks of sites, its interpretation would fit well with a satellite system. For example, the industry's interpretation might be organized around several site-dependent subthemes: transportation (roads, railroads, canals, bridges, tunnels); raw materials (iron ore and coal mines, limestone quarries, and coke ovens); labor (housing, churches, union halls, cemeteries); iron and steel making plants; and manufactured products (tools, barbed wire, rail, and architectural elements).

Since it is likely that some visitors would tour only one site in the system, sufficient interpretation would need to be given at each site in the satellite network to provide a sense of closure. Visitors would also need to be given the basis for understanding how each site functioned as a unit.

The problem of providing visitors with an understanding of the interrelationships among the components of an industry by means of programs and exhibits at satellite units is a difficult one. While an ancillary industry such as coal mining might be better interpreted at a mine site, it is important that steel making be presented as an integrated activity. A network of sites that presents steel making in a fragmented manner would yield fragmented understandings. Interrelationships among industries were also crucial historically.

This dimension must be effectively represented if programs and exhibits are to convey a true impression of integrated industrial processes. Iron and steel making will need to be related to other industries such as ceramics, coal, railroading, and glass. A museum may be necessary to accomplish this element of interpretation, either in conjunction with a site or at a more centralized regional location. Pictorial representations would be an important aspect of any approach in this area.

MAINTAINING SITES, CENTERS, AND NETWORKS

A regional or national organization will be required to develop, oversee, and coordinate activities at the satellite units of a network. In addition, the expense of maintaining the units would be the responsibility of that body. It is unlikely that the finances of local agencies, public or private, would permit them to take on a project of this magnitude.

The best approach for development and maintenance of these sites is likely to be a partnership of a national level organization, such as the National Park Service or the Smithsonian Institution, with state, county, and municipal agencies. Local agencies should also be encouraged to participate in site interpretation and other functions. A commitment to collecting, preserving, and interpreting industrial history would be required of any agency involved in the program. Development of professional guidelines and standards for the site network would also be necessary. It is especially important that groups entrusted with the stewardship of America's industrial heritage be dedicated to their role as museums for this part of our common past.

V: ANALYZING INDUSTRIAL SITES: THE IMPORTANCE OF CONTEXT IN UNDERSTANDING MATERIAL CULTURE

People seek out the material remains of the past – places like restored historic structures, landscapes, gardens, and museums – for reasons that are not fully understood or easily stated, and the professionals whose job it is to restore such material and present it to the public are guided as much by experience and intuition as by anything else. Do people simply come for a pleasant experience? A diversion from their everyday concerns? To broaden their intellectual horizons? Out of curiosity?

Simple answers to these questions only provoke more inquiry. What exactly is a pleasant experience? How is it produced? How can visitors' curiosity be satisfied if they are unable to say just what it is they are curious about? Is the responsibility merely to entertain or is it to inform, is it to please or to challenge?

Among all these questions, we only have a sure answer to the last. The others have to do with the motivations of visitors, about which we can only speculate, however much we ground that speculation in reason and research. The last question has to do with our own ethical treatment of the past. The National Park Service, consistent with its mission and policies and its position as one of the leading cultural resource organization in the United States, can answer the last question in only one way: the experiences that cultural resources allow us to provide must be educational as well as enjoyable.

But this goal of making the experiences both educational and enjoyable brings us back again to many of the same questions. Why do visitors come to a "restored" site, with its image of material culture preserved from an earlier time? And how can these motives be satisfied? That visitors have difficulty interpreting their own motives is evidence that these motives are largely unconscious. In deciding to visit a restored site, however, visitors set in motion a process that may challenge their assumptions, conscious and unconscious, about how the past has brought us to the present.

How this happens, how meaningful information about the past is conveyed by a restored site, requires close examination. Elements of material culture – buildings, landscapes, transportation systems, machinery, furnishings – "speak" to us using a nonverbal language, the workings of which have been studied by linguists and anthropologists, including Claude Levi-Straus, S.I. Hayakawa, Henry Glassie, and Edward Hall. This language that artifacts of earlier times speak is understood by most observers at an unconscious or preconscious level.

Because the language of material culture is generally not explicit, there is always the risk that erroneous messages can be sent, intentionally or not. Very special care needs to be taken in the restoration of sites, including industrial sites, to ensure that, despite the inevitable editing, the message is accurate. With care, the nonverbal language of material culture can indeed speak to us about the past, about its creators and their environment. To accomplish this, nonverbal messages and the meaning conveyed to the visitors need to be made more explicit, and thereby brought into greater consciousness. Knowledge of the nonverbal language can make the sites we restore more effective and may encourage visitors to engage in dialogues concerning the meaning of the sites. This type of interaction between visitors and restored sites, and between ourselves and our common past, must be recognized.

CONTEXT AND UNDERSTANDING

Yet little is known about the precise workings of material culture as a nonverbal language, despite study by linguists and anthropologists. Among the most far-reaching studies is Henry Glassie's identification the "grammar" of vernacular architecture as exemplified by folk housing in middle Virginia. Conducting a structural analysis of the same the type as employed by Noam Chomsky to study languages, Glassie identified a "generative grammar" for these structures which provided the rules, unstated and unconscious, followed by the builders of these houses. The rules held for the folk buildings in the study area, even though these structures had been built without plans or blueprints over a period of more than a century.

The grammar of most other varieties of material culture remains unknown, but some generalizations can be made about the workings of any language. Foremost among these is that language must have context to successfully convey messages. Edward Hall has said that "contexting is apparently deeply embedded in processes governing the evolution of both the nervous system and the sensory receptors." By way of example of how context must be present in spoken communication, Hall describes controlled experiments wherein a listener "fills in" a syllable or word in a sentence that has been obliterated from hearing by background noise, and does this so unconsciously that he believes that he actually heard the missing syllable or word. When a word is repeated many times without context, though, the listener will hear and understand it in many different forms.

The importance of context in understanding the language of material culture is exemplified by the standard methodology of archeology. It has long been recognized that context is essential to archeology. Indeed much of the effort devoted to rendering archeology "scientific" has been directed to the use of rigorous methods of establishing and reconstructing context. An artifact's meaning is greatly impaired if the context in which it has been found is destroyed or damaged. This is the reason for the legislation that discourages people from disturbing archeological sites. Once context is destroyed through construction or looting, artifacts associated with the area can never really be understood. An arrow point in a museum is merely a curiosity. Found in context it can be the key to learning who used it and when, what they were hunting and what else they were eating, what the climate was and what sorts of dwellings were built and occupied, who obtained the material for the point and how.

By using the carefully recorded circumstances of context, archeologists abstractly reconstruct the site, "reading" meaning through the relationships among site elements. They are helped (and sometimes hindered) in their literacy by the exposure they have had to other artifacts and sites. They grow familiar with reading certain kinds of meanings into sites, as people who have long known each other grow familiar with reading certain kinds of meanings into the communication they have with each other.

CONTEXT AND THE RESTORATION OF HISTORIC SITES

Context is no less essential to the understanding of a restored historic site. A site is certainly as much an artifact, as much a product of human effort, as an arrow point. And in their meaningful aspects, sites that are restored undergo something analogous to the rewriting of a verbal text. An even better analogy is that restoration of a historic site is like, or should be like, the interpretive treatment of an ancient manuscript.

Visitors read sites using both a verbal, conscious language, and a nonverbal, preconscious language. Communication, which many anthropologists argue is the essence of culture, is accomplished not simply through words but also through the arrangement and alteration of the visual, aural, tactile, and olfactory environment. Each type of language can contribute to the interpretation of the restored site. Each has strengths and weaknesses.

Verbal messages, by being explicit, can be questioned or disagreed with. One can carry on a dialogue with the person conveying such a message, perhaps negotiating or amending the meaning intended by this person. However, the conscious, verbal message is inescapably an abstraction. One is removed by the abstraction from the actual event or object that is the subject of the abstraction. Every abstraction carries with it a certain distortion, in that events and objects are singular to a greater or lesser degree, and it is the nature of abstraction to ignore this. Abstractions are general and therefore can be erroneous or biased. This may be inevitable because abstractions are applied to events and objects only by humans, who are themselves singularly idiosyncratic.

Nonverbal languages are largely preconscious. Until the meaning conveyed by nonverbal language is made conscious, one cannot effectively engage in a dialogue about that meaning. A person consciously fluent in a nonverbal language could therefore manipulate the sentiment of one less conscious of the workings of the language. This phenomenon is frequently seen in propaganda or advertising. Applying preconceived notions to the past concerning the look, sound, smell, and feel of events and objects that originated there can obliterate the nonverbal message that might have been obtained through the "unedited" material culture. A warning voiced by Hayakawa applies to both verbal and nonverbal languages. His example here of nonverbal language is visual language:

> And having matched the data of experience with our abstractions, visual or verbal, we manipulate these abstractions, with or without further reference to the data, and make systems with them. Those systems of abstractions, artifacts of the mind, when verbal, we call "explanations" or "philosophies"; when visual, we call them our "picture of the world." With these little systems in our head we look upon the dynamism of the events around us, and we find, or persuade ourselves that we find, correspondences between the pictures inside our heads and the world without. Believing these correspondences to be real, we feel at home in what we regard as the "known" world.

Another name used for systems of verbal abstractions is history. History written for recent events picks out from the flux of human experience only what the contemporary audience believes important or acceptable. Newspapers in the antebellum South did not report incidents of slave beatings. The frequency of child abuse went unrecorded in this country until just a few years ago. As the events for which histories are written recede farther into the past, the "trap" of abstraction deepens because there is less opportunity for verification through direct experience. Also, with each rewriting of history, we must perceive experience through yet another "translation." All translations are biased, at least by the language into which they are being translated.

CHALLENGING STEREOTYPES WITH MATERIAL CULTURE

Our sole experiential avenue to the past is through surviving material remains: artifacts, broadly defined, varying in type from features such as rock-lined hearths to environmental remains such as pollen or phyoliths. Without attention to this material, commonly recovered by archeological methods, our "picture of the world" is determined solely by our histories, our abstractions.

Restoration of a historic site provides an opportunity to remove at least some of the bias that inevitably creeps into our understanding of the past. Restoration can challenge stereotypes that derive from the abstraction of the verbal language. However, this can happen only if the restoration itself challenges nonverbal stereotypes, if the restoration is based on and scrupulously includes all surviving, representative cultural material. Designers and planners must learn to resist the temptation to "edit out" those aspects of material culture that do not fit in with our abstractions and biases.

Williamsburg, the venerable ancestor of all modern restorations, begun in 1926, is doing just this, according to a recent article in *The Atlantic Monthly.* After years of criticism by some architectural historians and others who found the restored city to be "far more elegant than the real Colonial city could ever have been," a serious attempt is being made to induce a greater accuracy of the site. Lawns are being allowed to grow, paint is being left to fade, and horse manure is being left on the streets.

The temptation to edit the material of the past will be particularly great at industrial sites, where we may be dealing not just with historic privies and trash, but with toxic waste and dangerous working conditions. Not only must we deal with our aversion to material such as this, but also with our inclination to frame industry in a more park-like atmosphere – one that tempers the effects of the man-made environment with trees, shrubs, and flowers. Industrial sites, particularly 19th century industrial sites, are not "natural" places. Their relationship with nature is largely antithetical: the environment at a 19th century industrial site does not look, smell, sound, or feel like one that is conducive to biological life. The scale of an iron and steel plant is typically huge – humans are dwarfed and engulfed. The smells are frequently noxious if not toxic. Noises are dissonant, harsh, and loud enough to threaten damage to human ears. One walks over gritty or slippery floors through areas hot enough to cause discomfort or, if one lingers, sickness. Nonetheless, the meaning of the site and the artifacts within the site, the industrial machinery, depends on this context. It is this environment that forms the background for the human events that affected production, and this background is essential to meaning.

Accurately and completely restored physical environments speak their own language – a language in which all of us, preconsciously or otherwise, are to a greater or lesser degree conversant. But they also form the essential backdrop for and material of the verbal interpretation of the human events and the economic, technological, social, and ideological structures that comprised the industrial era. The key here, as with material culture considered alone, is coherence; sufficient and noncontradictory context must be provided for the verbal interpretation of the site. In the same way, verbal interpretation can provide context for the visitors' interpretation of the nonverbal, but meaningful, environment. And it can provide further context for progressively more abstract interpretations of the site or artifact and its relationship to even larger contexts, such as the community, the geographical region, the state, the nation, and eventually the world.

The accompanying chart shows how interpretation of the industrial site can be conceived along two dimensions. The top of the chart provides a measure of the degree to which experience has been abstracted "linguistically" – the degree to which experience has been reduced to a symbol. This progresses from spoken language, to written language, to systems of abstractions, which Hayakawa has referred to as "artifacts of the mind." Along the side of the chart is a measure of scope of context that begins with the individual artifact (machinery) and progresses through the complex of artifacts (the work station and factory) and the spatial and geographic (or demographic) spheres that provide the ultimate context for the artifact.

Each focal point on the chart can be related to any or all of the other points. The points in the upper left-hand quadrant of the chart, however, are those most accessible to the largest number of people because they do not demand prior familiarity with the overall subject matter of industry and the industrial era. They provide an experience that can be enriched by further exploration of the larger restored environment and by introduction to progressively greater abstractions concerning the industrial era. This would be a valuable experience for people regardless of their previous familiarity with the era and its material culture.

Reactivated machinery, for example, is held by many to be the best, and perhaps the only, way to interpret the operation of the large and complex machinery typical of the era. Process and product are ascertained with relative ease when one has the opportunity to watch the pouring of iron from a furnace or the operation of a rolling mill. To adequately describe and explain these operations verbally is much more difficult, even when aided by drawings and photographs. Also, as noted elsewhere, verbal descriptions deprive one of the full sensory experience associated with the operation of the machinery, which is typically arresting and thought-provoking. From this initial involvement with the machinery, the visitor can be introduced to the people who operated the machinery and to progressively larger human and spatial contexts and greater levels of interpretive abstraction.

It is not essential for visitors to experience this precise interpretive situation, but this is one of the most likely ways of engaging them. Visitors might also become involved with the industrial story by investigating the cultural landscape of the town. This might include historic road and sidewalk surfacing material, details of typically ethnic decorations displayed for holidays, evidence of typical historic activities such as laundry hanging out, or other chronologically anomalous features and activities such as privies or horse-drawn carts. Alternatively, visitors might be introduced in the overall interpretive scheme by exploring an outlying owner's estate, perhaps attracted by its 19th century opulence. Their experience might logically begin at the visitor center, where a more abstracted introduction to the site can be

INTERPRETIVE FOCAL POINTS

		lesser	LEVEL OF LINGUISTIC ABSTRACTION	greater
		Nonverbal →	Verbal →	Schematic
smaller	MACHINERY	Reactivated Machinery		Interpretive Signs Tours / Brochures
	↓	Replicated Work Stations		Slide Shows
			Living History	Models
	FACTORY	Work Environment (noise, smell, visual scale, human interaction, graffiti)		Museum Displays
			Factory Tours	
	↓		Archeological Site Reports	Site Histories
		Landscapes (vegetation, sanitation, sidewalks, paths, streets, domestic animals, wildlife)		
			Public Archeology	
	COMMUNITY	Workers Housing		Local Histories
SCOPE OF INTERPRETIVE CONTEXT		Local Businesses		
	REGION		Community Tours	
		Housing		Syntheses of Archeological Data
		Community Leaders		
	STATE		Material Culture Studies	
		Social Leaders		Social Histories
		Factory Owners' Estates		
	NATION			Symposia
			Visitor Center	
	↓			
	WORLD			Socio-Cultural (Anthropological) Analyses
larger				

provided, and directions to the other components of the site offer a more experiential contact. Visitors could also be introduced to the site through a symposium or printed literature pertaining to the history, historic activities at the site, or an abstract treatment of them.

The interpretive schemes offered here do not disallow such abstracted treatments of a site. Accuracy of interpretation at the restored industrial site, accuracy that includes details that might seem objectionable by today's standards, must also include historical, i.e., abstracted, presentations concerning events and conditions that characterize a site's past.

In one such abstracted presentation, Marvin Harris reminds us that although the industrial revolution was 500 years in the making, it resulted not in an increased quality of life but in misery for the humans involved for all but the last 150 years. Harris says that "the periods of the greatest technological innovation were those of greatest population increase, highest cost of living, and greatest amount of suffering among the poor." Furthermore, it was not until the last quarter of the 19th century that the middle class comprised more than a small percentage of the European population. Tuberculosis, rickets, and other diseases brought about by poor diets were endemic among the lower classes. In Sweden in the 18th century, where relatively reliable records were kept, the mortality of infants whose births were recorded was 21 percent in the first year of life.

This analysis corroborates many other historical accounts of industrialization, including that of John Burnett, who compiled a number of rare written accounts of the daily life of the working class in the British Isles as recorded by the working people themselves. In his preface, Burnett notes, ". . . uncomplaining acceptance of conditions of life and work which to the modern reader seem brutal, degrading, and almost unimaginable – of near poverty and, sometimes, extreme poverty, of overcrowding and inadequate housing accommodation, of bad working conditions, periodic unemployment and generally restricted opportunities, and the high incidence of disease, disablement, and death."

Jean Gimpel traces the origins of industrialization, and corresponding social and ideological changes, to the Middle Ages, as his main thesis in *The Medieval Machine*. This historical perspective, removed in space as well as in time from the industrial sites in this country, is nonetheless needed as part of the context in which to see the working conditions, labor relations, and rise and decline of unions here.

PROVOKING THE OBSERVER TO FOCUSED FEELING AND THOUGHT

Much of what can be experienced by the visitor to a restored industrial site can be meaningful not only in terms of the human experience of the worker within the industry, but also in terms of the social, ideological, and economic context within which the industry operated. Again, this is illustrated on the Interpretive Focal Points chart. The accurately restored site provides a vivid sense of historic conditions; it constitutes what might be thought of as a metaphor of these conditions, in much the same way that a painting, a piece of music, or a novel constitutes a metaphor.

Criteria useful for evaluating the metaphor embodied in a restoration include its ability to evoke focused feelings and thought, the precision of its portrayal of the subject, and the sensitivity to context which it exhibits. Nonverbal communication must occur for these criteria to be employed, even preconsciously. Some visitors will bring with them knowledge which aids their interpretation of the nonverbal messages; but this abstracted, stereotypical knowledge may be challenged by the nonverbal messages they encounter. It could be uncomfortable for visitors if the latter occurs, yet valuable. Other visitors will come with little formal knowledge of the era represented, and still the metaphor presented would, if well designed, provide them with a vivid, focused grasp of its nature.

As examples of the meaningful nature of context at restored industrial sites, consider some of the elements of material culture associated with the America's Industrial Heritage Project and with Steamtown National Historic Site. Such elements, or features, speak to us nonverbally, but also might serve as the focus of a verbal presentation given by interpretation, signs, pamphlets or books, models, and slides or videotapes.

In the 19th century roundhouse at Steamtown, inspection pits that doubled as drainage pits were found under tracks arranged like the spokes of a wheel. A man in an inspection pit might be able to sit up, but not stand, and would crawl along the pit to look at the undersides of locomotives being serviced in the roundhouse. The floor of a pit, a few feet wide, was crowned so that water, solvents, oil, grease, and bits of the asbestos insulation from the engine boilers were drained into gutters on the side of the pit, and from there to a drain near the center of the roundhouse. Visitors to the site are presented with a graphic illustration of the working conditions there. Something of the attitude toward the environment is also communicated when the visitor learns that the roundhouse was drained into a nearby river.

Similar lessons can be learned at Johnstown. There, active rolling mills expose visitors to severe heat, noise, and regimentation of movement similar to the day-to-day environment for steelworkers in the 19th century. Vacant lots at Johnstown, devoid of vegetation because of heavy metals such as chromium in the soil, are further evidence of an earlier ignorance of environmental concern. All of these features establish the context for the visitor's overall experience and imply the context of the larger ideological, social, economic, and political environment.

This also occurs as we move outward from the factories to the surrounding communities. Workers' housing is relatively spartan and regimented, but may be seen within the context of the churches, schools, clubs, and business establishments that constituted a social and economic network. Included in this network are institutions supported by the workers and their organizations, the local and state governments, the factory owners, and ideological organizations. The physical environment can be seen as the result of an interaction of all of these agencies. Restored in a way that replicates important aspects of people's lives, such as vegetation, sanitation, lighting, crowding or spacing of structures, streets, sidewalks, signs and graffiti, wildlife and domesticated animals, it can evoke thought about the institutions that produced this physical environment.

Focal points for interpretive programs can also be provided. One would expect to find that the houses and neighborhoods of community, political, and social leaders, of the bourgeois, and of the factory owners, would provide different physical experiences. These should also be presented, not only because the restorations provide interesting contrasts, but also because elements in the neighborhoods more clearly reflect involvement in the larger economic and political network of the nation and the world.

As previously noted, the nonverbal messages received by the visitor may challenge some of the stereotypes he has held concerning the portion of the past represented at the site. We tend to grow comfortable with our assumptions about the messages we are getting from the world around us, and we grow attached to our concept of the world, which may or may not actually match the events of that world. Our abstractions become the context we use in interpreting events, and we are often surprised to find that we are interpreting those events incorrectly. When this occurs, we become increasingly estranged from these events and their real meaning.

The reexamination of assumptions about our common past may be surprising, even uncomfortable, in a way similar to our reaction when we challenge assumptions about our contemporary human relationships. But, as with the latter case, the discomfort may be temporary and the rewards more long-lasting. As one example of this, despite some distinctly uncomfortable and unpleasant aspects, and perhaps partially became of them, people are typically fascinated with industrial sites. After all, human ingenuity created these artifacts. Almost nothing appears as it did before it had been subjected to some prior industrial transformation. Even the buildings do not resemble the rocks from which they were rendered. The scale of this transformation is evidence of a compelling human motivation. Each of these sites speaks of a power to move a vast amount of material and a human effort in concert with a grand plan. People wonder, perhaps, about the day-to-day existence of those who envisioned and executed such an enterprise, as well as the lives of those who worked in the deafening noise and suffocating heat.

THE APPEAL OF HONEST RESTORATION

It is these kinds of questions that compel a person to visit a historic site, rather than to learn about it in some other manner, such as from a book or television. Media cannot express or display heat from a rolling mill. One cannot really appreciate the size and grandeur of the owners' mansions or the simplicity of the workers' housing. Details in the environment are too numerous and subtle in their interactions to be captured in print or on film. If a picture is worth a thousand words, then a visit to a restored historic site can be worth volumes.

Although such a visit can be valuable, it could also easily be misrepresentative. Historic structures, even mills and factories, can be gentrified into shopping malls. Such structures do not provoke the sorts of speculation mentioned above; instead, they provide to a person interested in the past a less compelling reason for travel or return, no matter how alluring the merchandise may be in the shops. While the experience provided by such a structure may be pleasant, it is not profoundly suggestive or compelling. A similarly pleasant experience might be provided by the local shopping mall, or a visit to the shopping district of any city. There is little reason to think that such an attraction would be enough to draw visitors from any place but local communities. As David Lowenthal quoted L.P. Hartley, "The past is a foreign country, they do things differently there." If this is not evident at a historic site, it may not be worth the trip in the eyes of the visitor. Verbal interpretation can help with the language of this foreign country, and reassure the visitor about some of the strange customs practiced there. However, without the nonverbal context, a site visit would be like studying French, rather than visiting France: not as rewarding and certainly not as interesting or enjoyable. Rewarding and compelling restoration, then, is based on an honest portrayal of the past through both verbal and nonverbal language.

SUMMARY OF RECOMMENDATIONS

INVENTORIES OF INDUSTRIAL SITES AND ARTIFACTS

Macro and micro inventories are needed as a first step toward identifying and evaluating historically significant, representative industrial sites and artifacts. A consortium of interested parties must be established to oversee the inventories and undertake the difficult task of determining criteria for the preservation of our industrial heritage. Documentation concerning the sites and artifacts also needs to be preserved in an archivally appropriate fashion. A central office should be established to serve as the repository of information collected by the inventories.

THE CURATION OF INDUSTRIAL ARTIFACTS

The classification of industrial artifacts is complicated by the fact that immovable artifacts have traditionally been regarded as structures rather than elements of collections. However, modern systems for the classification and description of collections provide a standardized basis and terminology for including large industrial artifacts and structures as integral elements of museum collections. It is essential that, where possible, efforts be made to preserve all the elements of industrial processes, so that the context of industrial machinery remains available for study and interpretation.

Indoor storage is always preferable to outdoor storage; as a minimum, artifacts should be kept from driving wind and rain. As with any museum collection, the facilities for industrial collections should meet basic curatorial standards. Regional storage facilities may be superior to one or two centralized facilities for reasons of accessibility to potential visitors, costs of transporting artifacts, and preservation of context.

THE CONSERVATION OF INDUSTRIAL ARTIFACTS

The large size of many industrial artifacts makes treatments lengthy, labor-intensive, and costly. Some artifacts are impossible to move, and conservation they might need would have to be done on site. Because of these factors, the AIHP should employ a variety of preservation strategies, including restoring operating machinery, cosmetic make-overs, and passive storage. Thoughtful selection of artifacts to be conserved and the treatment to be used will be crucial. Facilities for conservation activities may be adaptable from existing spaces and equipment at historic mill sites, but upgrading would be needed. The facilities should be equipped with a variety of material-handling devices as well as a machine shop, which may be regarded as the most important support service for the conservation of industrial artifacts. In addition, such a facility would need to have an outreach program to provide technical assistance to sites where immovable artifacts are located. Conservation personnel will need comprehensive training and experience to deal safely and effectively with the materials found in industrial artifacts, as well as to discuss with other specialists the significance of artifacts and appropriate preservation strategies.

THE INTERPRETATION OF AMERICA'S INDUSTRIAL HERITAGE

No one site can tell the whole industrial story. A national level organization, in coordination with other interested parties, will have to develop, oversee, and coordinate the activities of sites in a network. Depending on the nature of the industry to be interpreted, a national or several regional centers would be appropriate. In either case, satellite units would be needed to interpret industry. Satellite units would also be focal points for efforts in local preservation.

THE IMPORTANCE OF CONTEXT

Context is essential to convey the meaning of industrial artifacts to the visitor. Ideally, machinery should be kept in its operating location and condition. Moreover, context should include landscapes and cityscapes – preserved neighborhoods, businesses, churches, and other institutions. Within this broadly restored context there would be focal points for interpretation. Depending on the focal point selected, interpretation could be artifact-specific or global, experiential or theoretical. For example, operating machinery can impart the experience of the worker, while restored workers' housing can introduce economic and political themes. Multidisciplinary approaches are needed to devise interpretive programs based on the restored environment.

MEMBERS OF THE LARGE INDUSTRIAL ARTIFACT ADVISORY PANEL

John Bowditch ▸ author of section I
Henry Ford Museum
P.O. Box 1970
Dearborn, Michigan 48121

Sharon Brown
National Park Service
Denver Service Center
Denver, Colorado

Martin Burke
National Museum of American History
Smithsonian Institution
Washington, D.C.

Richard Burkert ▸ author of section IV
Johnstown Heritage Museum
304 Washington Street
Johnstown, Pennsylvania 15901

James Burnham
Henry Ford Museum
Dearborn, Michigan

Robert Casey
Schloss Furnace
Birmingham, Alabama

Douglas C. Comer ▸ author of section V
National Park Service
Denver Service Center
Applied Archeology Center
11710 Hunters Lane
Rockville, Maryland 20852

Donald Cumberland
National Park Service
Harpers Ferry Center
Harpers Ferry, West Virginia

Keith Dunbar
National Park Service
Denver Service Center and America's
Industrial Heritage Project
Cresson, Pennsylvania

Gray Fitzsimons
National Park Service
Historic American Buildings Survey/
Historic American Engineering Record
Washington, D.C.

Earl James
Pittsburgh Historic Landmarks
Pittsburgh, Pennsylvania

Emory Kemp
West Virginia University
Morgantown, West Virginia

Walter Kidney
Pittsburgh Historic Landmarks
Pittsburgh, Pennsylvania

Tony Knapp
National Park Service
Curatorial Services
Washington, D.C.

Earl McElwain
Braeburn Alloy Steel
Lower Burrell, Pennsylvania

Lance Metz
Canal Museum and Highmore Park
Easton, Pennsylvania

David Orr
National Park Service,
Mid-Atlantic Regional Office
Philadelphia, Pennsylvania

Vance Packard
Drakewell Museum
Titusville, Pennsylvania

Michael Parrington
John Milner Associates
Philadelphia, Pennsylvania

Bart Rogers
National Park Service,
Harpers Ferry Center
Harpers Ferry, West Virginia

David Salay
Oklahoma Historical Society
Oklahoma City, Oklahoma

Amy Schlagel
National Park Service
National Register of Historic Places
Washington, D.C.

Katherine Singley ▸ author of section III
National Park Service
Denver Service Center
Applied Archeology Center
11710 Hunters Lane
Rockville, Maryland 20852

David Starbuck
Rensselaer Polytechnic Institute
Troy, New York

Robert Vogel
National Museum of American History
Smithsonian Institution
Washington, D.C.

David T. Wilson ▸ author of section II
Ohio Historical Society
Youngstown Historical Center
of Industry and Labor
151 West Wood Street
Youngstown, Ohio 44503

William Worthington
National Museum of American History
Smithsonian Institution
Washington, D.C.

Paula Zitzler
Berger & Associates
Rockville, Maryland

***Document Editors*:**

John F. Pousson
National Park Service
Denver Service Center
Applied Archeology Center
Rockville, Maryland

Douglas C. Comer
National Park Service
Denver Service Center
Applied Archeology Center
Rockville, Maryland

Sandy Schuster/Linda Russo
National Park Service
Denver Service Center
Denver, Colorado

As the nation's principal conservation agency, the Department of the Interior has basic responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

Publication services were provided by the graphics and editorial staffs of the Denver Service Center. NPS D-4 February 1991

U.S. GOVERNMENT PRINTING OFFICE 1991—573-040/20,033 REGION NO. 8