Lecture 3

Integration of signs of former use and degradation into the future use

Intro

Lecture 3 deals with the reading of sites showing traces of former use and degradation. In the first part of the lecture Dieter D. Genske characterizes an approach used in the process of remediation planning, the *pre-closure site audit*. Its results are decisive for the future use of brownfields and the process of “remediation”. In the second part Susanne Hauser defines different expectations which have been functional in approaches to “remediation”. In the third part Dieter D. Genske gives a survey of today’s remediation tools. Part four and five (Susanne Hauser) line out some common considerations of former use to mitigate future disasters and to develop aesthetic redevelopment strategies.

Consideration of former use to optimize remediation planning (Dieter D. Genske)

In order to halt excessive *greenfield* consumption, the British Government has decided that 60% of all new housing shall be established on brownfields by the year 2015. In Germany, it is planned to cut *greenfield* consumption by 75% by 2020 (anon. 1998), a reduction still considered insufficient by the *Council of Environmental Advisors to the German Government* if directives to protect nature, climate and biodiversity are to be implemented (RSU 2000). The *fit-for-purpose approach*, aiming at adjusting future utilisation to the grade of degradation, may help to recycle derelict land: highly degraded sectors may be turned into parking lots, green belts, or sealed service terrains, whereas good quality land may be reused for housing, schoolyards, or administration.

In the European Community three strategies to recycle land can be distinguished Ferber (1995:16):

- *Remise en état,* i.e. preliminary refurbishment of the site to attract further investment to finance a thorough clean up. This method is preferred in regions with a low economic profile such as Lothringen in France.
- *Re-dedicating*, i.e. using the site for tertiary purposes such as domestic areas or parkland. The costs to satisfy clean-up regulations are, however, quite substantial if the former industrial site is to be used for housing. Examples of this strategy are the *Urban Development Corporation UDC* in England, the *London Docklands*, or

certain remediation projects in the German Ruhr District. Another attractive variation of land re-dedicating is the conception of recreation areas and nature resorts, which are urgently needed in the overpopulated industrial regions of Europe. In former (subsurface) mining districts that suffer from subsidence, wetlands and secondary biotops can be readily integrated into recreation areas. Examples of secondary nature resorts can be visited in the German Ruhr District where the *Bundesgartenschau* (a national garden fair) provided the necessary funds to convert abandoned industrial sites into parkland.

- *Revitalising industry*, i.e. re-establishment of industry on the abandoned site. The European Community prefers this strategy and subsidises appropriate projects since this leads to the creation of new long term jobs, thus effectively decreasing unemployment rates. Typical examples are remediation projects in former eastern Germany such as the steel mill *Riesa* or projects of the *Internationale Bauaustellung Emscherpark IBA* in the German Ruhr District. This strategy is also in line with the suitable-for-use approach of the German Ministry of Environmental Protection that fears the costs connected with a full restoration of a contaminated site to the original condition.

With these strategies in mind, a land remediation project usually starts with a *pre-closure site audit*. A pre-closure site audit reconstructs the utilisation of the site to date, identifies where surface and subsurface structures are located, whether parts of buildings are potentially contaminated, whether tanks or pipes contain hazardous substances, whether contaminated materials have been stored or deposited on-site, and where accidents have taken place causing possible ground contamination. The pre-closure site audit also analyses which components of the site can be recycled or downcycled. The sources of information to be exploited are the ones already mentioned in Rational I (Lecture 2), which comprise primarily site maps, documentation of buildings and facilities, aerial photographs, statistics on quantities of goods as well as wastes produced, accounts on accidents, and reports from workers in charge of operating installations.

An audit of this kind may become complicated for vast industrial installations where different generations of utilisation have caused complex material flows. The pre-closure site report should include the following elements:

- Description of the present use of the site including a detailed map of all existing installations indicating their use and hazard potential. Special attention has to be paid to waste storage facilities.
- Present environmental status of the terrain and its vicinity including data on soil, groundwater and air quality.
- Former utilisation of the site including maps, production records as well as waste handling policies.
- An exhaustive record of accidents that have taken place on the premises with indications of possible contamination caused by fires, explosions, as well as spillage or leakage of hazardous products.
- Buildings and features to be preserved due to their archaeological importance and the interest of the public in protecting its industrial heritage.
- Installations, machinery, and other items that may find potential buyers.

- Demolition material that can be recycled or downcycled.
- Structures to be saved because they may be utilised during the demolition and clearance work as storage, recycling, or treatment facilities.

Remediation ratio (Susanne Hauser)

In 10% of the investigated cases where hazards have been identified according to the given standards, the remediation begins following a decision-making process which determines the aims and procedures within a remediation plan. The term "remediation" (in German: “Sanierung”) has its roots in the 19th century debate on hygiene and in the corporeal metaphors of modern urban planning. In connection with the built-up environment, remediation is a process that aims at the recovery of a structural or social entity interpreted as an organism. However, the metaphorical reference to an organism as a whole is missing in the new definition of remediation as applied to dangerous wastes from the past. The new definition is not aimed at the recovery of an organism, but at the "protection against hazards" in places where hazards have been identified.

The protection against a hazard is not defined in an absolute, but in a relative sense: "Remediation applied to dangerous wastes from the past entails the implementation of measures which ensure that no hazards to human life or health, the animate or inanimate environment, emerge from dangerous waste from the past in connection with the current or planned utilization of the site after the remediation has taken place."

Decontamination and detoxification in the sense described above, therefore, denotes a remediation procedure, and according to the German Federal Soil Protection Law, it is a measure that has priority over safeguarding. Decontaminating measures are designed to remove, dispose of, or dilute harmful substances, " so that the treated soil can be reused as filling material on site or in a different location without risks to the environment" (German Federal Department of the Environment, 1994, 19). A site can be decontaminated by transporting "hazardous substances" or "contaminating materials" away to a secure waste site, a location of disposal that is reserved for pollution and enables its controlled confinement to a designated zone.

However, preference is given to the "clean-up" or "safeguarding" on site. "Clean-ups" with respect to soil and water are performed on the former production site or next to it by using thermal, chemical-physical, and microbiological methods on the site of dangerous wastes from the past or in other locations after soil excavation.-Safeguarding is the second best solution after decontamination not only for the secure disposal in a different, remote location. Safeguarding techniques include the construction of geological barriers and structural sealing among others. Their function is to interrupt emission paths, pathways through which gases and water can spread harmful substances. The next chapter explains the various remediation techniques in more detail.

Remediation measures are generally designed to make harmful substances more controllable so as to confine the previously defined hazards to a designated location, and thus to create zones which are exempt: Ideally, they are isolated from any process of mechanical dislocation or metabolism. Measures aimed at withholding harmful substances enjoin more or less intensive monitoring activity depending on the quality of the substances and the nature of confinement: Their effectiveness has to be made subject to control, and "technical failure has to be ruled out with sufficient certainty" (Freier et al. o.J., 4). This leads to the creation of a controlled environment which is defined and remedied via the control of measured values and quantities based on hazard assessments and in which undesirable residues can be banned to be "tamed" and kept safe for future control activity.

The *Sachverständigengutachten* (Expert Report) of 1989 (German Council of Experts for Environmental Issues, 1990) already mentioned takes the intimate connection between "hazard" and future "(land) use" into account and thus reflects the practice of handling dangerous wastes from the past which has become increasingly prevalent in the last few years. Consequently, it is generally no longer a matter of "cleaning up", or complete "remediation", or what is implied by the word "recovery" in the sense in which medical metaphors and terminology are used, but one of a practice that is contingent upon a context of various considerations that are weighed up against each other: "The 'pure doctrine' of the soil conservationists of the first generation with their high aims and demands for remediation in grade A Holland quality according to area-wide playground standards has proven to be utterly unrealistic (...) In addition to guaranteeing the security function with regard to the biosphere, the quality aspect of subsequent use must, therefore, be granted even greater consideration in the future." (Bonberg/ Sobich 1995, 52)

The position of the Altlasten e.V. (ITVA), the most influential technical engineering association in Germany, founded in 1990 following the move of the German Federal Department of the Environment, Nature Conservation, and Reactor Safety to develop generalized quality standards, technical regulation and methods of solution, has followed suit in this respect. Its President, Hans-Peter Lühr, in 1996 described this transition as follows: "The beginnings of the ITVA have been determined mainly by the aim to eliminate contamination in order to recycle contaminated sites for multifunctional reuse. The presence of harmful substances was the decisive issue without taking their separability into consideration. This view which can be described as a 'maximum demands' position encouraged many remediation companies to develop and install decontamination technology such as plants for soil washing and thermal or biological treatment on their own account. However, a fundamental shift in goals and values took place exactly at the time when this technology became available. Prompted by the recent realization of the estimated costs for remediation in the new *Bundesländer* (former East German states) based on this 'maximum demands philosophy', the desirable notion of general recovery became reduced, especially by the *Treuhandgesellschaft* (the trust handling the entitlements in the former East German states) to the mere notion of protection against hazards. This was accompanied by the shift of emphasis from decontamination towards safeguarding in the ongoing discussion that pointed out the equal importance of both fundamentally different remediation approaches. The notion of 'minimum demands' was thus coined. ... In the meantime, these positions have been sufficiently ... discussed. Experiences from the every day business routine have further contributed to this trend, so that the main attention could be focussed on a realistic treatment based on the given facts. ... Realism here stands for the protection from hazards as well as the more extensive use- and path-related remediation aims. Nevertheless, the possibility of removing harmful substances under natural scientific, technical, and economic conditions should always be taken into consideration." (Lühr 1996, 1) Restrictions in land utilization result from the fact that there are no appropriate methods available, or that the costs are regarded as too high. Efforts in remediation might not be regarded as feasible due to the costs involved, or also due to the fact that remediation itself may incur costs that jeopardize the overall benefits of the undertaking. The outcome of all this is a graded definition of use restrictions.

The latest trend adopts the idea of natural attenuation, the "controlled inactivity", as explained below.

Remediation tools (Dieter D. Genske)

Hazards emanating from contaminated sites in urban areas can be mitigated in the following ways:

- Protection measures and limitation of use as a temporary solution until measures for remediation can be carried out.
- Isolation of the source of contamination by interrupting the contamination pathways or trapping and immobilising the pollutants.
- Extraction as a means to permanently remove the contamination source.
- "Soft" remediation techniques

The choice of the most suitable reclamation method basically depends on five factors:

- The urban environment, i.e. the current utilisation of the site, the future use, as well as the urban quality of the city quarter.
- The geological environment, i.e. the morphology of the site, the soil and bedrock conditions, and the hydrogeology. Parameters that have to be determined before a remediation measure can be taken include the physical properties of the soil (e.g. particle size distribution, bulk density, porosity, strength properties, compressibility), the chemical properties of the soil (e.g. *pH*, soil organic carbon, ion exchange capacity, sorption), the hydraulic properties of the soil (e.g. permeability, water content). Basic hydrogeological data has to be known like the depth to the water table(s), the direction of groundwater flow and the flow velocity. Furthermore, the depth to bedrock and bedrock characteristics must be known.
- The types of contaminants, their concentration, toxicity, mobility, and spectrum. Generally, organic and

inorganic contaminants are distinguished. Organic contaminants can further be subdivided into volatile (VOC), semivolatile (SVOC), or nonvolatile components (NVOC). They can also be distinguished according to their solubility in water and their unit weight: non-aqueous phase liquids are organic liquids that are not miscible in water, light nonaqueous phase liquids LNAPLs are hydrophobe and float on the surface of the groundwater table, dense nonaqueous phase liquids DNAPLs sink to the bottom of the aquifer. The mobility of the pollutant is controlled by its volatility and its solubility in water. A contamination source may provoke a plume polluting the aquifer in the downstream direction. The classification of contaminants into defined groups already suggests certain remediation strategies and thus eases the choice of the most appropriate technique. The question whether a contaminant concentration is considered acceptable depends on the natural background level, the future utilisation use of the site, and official regulations relevant for the location. Pollutants may be ecotoxic (i.e. disturbing or damaging existing ecosystems), carcinogenic (i.e. causing cancer), genotoxic (i.e. altering chromosomes and DNA, thus causing mutations), or foetotoxic (i.e. damaging the foetus). The spectrum of the contaminants may be homogeneous (e.g. an organic pollution in the vicinity of a filling station), or inhomogeneous (e.g. an industrial site with several generations of different utilisation). In the latter case a "cocktail" of many different contaminants may be present.

- The budget available to rehabilitate the site. In most cases both public and private partners participate in allocating the budget since they benefit economically from the revival of the site. This public-private-partnership has proven to be the driving mechanism in many rehabilitation projects in Europe.
- Finally, the choice of the remediation technique is governed by the goods to be protected. If, for instance, the contaminated site is located in a groundwater protection zone decontamination must commence immediately. A site contaminated with heavy metals adjacent to a school district or residential area must be fenced in and covered to impede dust blow.

The selection of the most appropriate remediation technology must be preceded by the site investigation. A large number of technical measures have been developed to mitigate hazards caused by contaminated sites, which are briefly outlined in the following.

Protection Measures

The first measure to take after a derelict terrain has been identified as problematic is to fence it in. Obligatory from the legal point of view, fencing in and setting up warning signs keep individuals from entering the site where contaminated installations and polluted soil as well as derelict building and underground structures give rise to safety problems. Fencing in is nothing but a first step in a remediation project and should always be considered a temporary measure. In cases where unacceptable environmental hazards are prompted by the site – for instance the contamination of groundwater – immediate decontamination measures have to be taken. If there are no immediate hazards the terrain may remain fenced in until an investor becomes interested in the site. While the terrain remains idle the fences have to be maintained in order to avoid possible legal complications.

A fenced-in site is left to a natural succession of flora and fauna, taking over the terrain gradually. Cases have been reported where derelict urban sites have become sanctuaries for wildlife and consequently have been recognised as such by local authorities. In some countries special laws prohibit the cutting of trees during the breeding session of birds or once the stems have exceeded a certain diameter. In these cases a remediation initiative may come to a standstill.

Isolation

Isolation measures aim at introducing barriers to confine the contamination source or to trap and immobilise the pollutants with physical or chemical means. A fundamental advantage of this approach is that the contamination is not touched and remains isolated or trapped in the ground. Of disadvantage is the fact that isolation and trapping technologies often disturb the natural subsurface conditions and that they need to be maintained and monitored. In order to isolate the contamination hot spot vertical cut-off walls such as sheet piles, slurry walls, vibrating beam walls, deep soil mixing walls, grout curtains, etc. may be introduced. If a contamination source is located above the groundwater table, and if this contamination doesn't move by gravitation, it may be sufficient to seal off the surface. A horizontal surface barrier obstructs the infiltration of rainwater, which would mobilise contaminants and carry them to the groundwater table. Surface sealing systems may be as simple as an asphalted parking lot or as sophisticated as a landfill surface liner that includes an impermeable geomembrane as well as drainage systems for water and gas.

Stabilisation

Injecting binding agents into the source of contamination immobilises the pollutants. A variety of injection agents is available including cement, pozzolanics, silicate gels. The injection material fills up the pores between the soil particles and binds them together, thus reducing the permeability and trapping the pollutants. The choice of injection material depends on the type of soil and the contaminant to be immobilised. As a general rule, cements are injected in gravel and coarse sand, silicate gels in sands, and special chemical products in fine grained sands and coarse silts. Finer silts and clays can not be injected since the soil pores are too small. Hence, for fine soils other methods of introducing binding agents like deep soil mixing are applied. Injections can also be made in bedrock to seal the fractures that act as migration pathways for contaminants.

Excavation and Deposition

A straightforward solution is to excavate the contamination source and dump the contaminated material on a landfill. Excavation is therefore considered to be a fast, efficient, and permanent remediation method. On the other hand, excavation is not always feasible because the contamination source might be located too deep in the ground or contaminants have already migrated into the bedrock. Furthermore, massive foundations left in the ground may obstruct the excavation work. A shallow groundwater table may considerably complicate excavation work. During the excavation process pollutants may be mobilised. Special safety measures have to be taken in order to avoid a direct contact with the contaminated material.

Excavation and Treatment

A simple disposal of extracted material is an option that is not considered an environmentally compatible solution since landfills consume space and have to be maintained for a long time. Moreover, the contamination problem itself is not solved, it is only handed over to the next generation, which then has to find appropriate solutions. It is thus recommended to treat the excavated contaminated soil, either off-site in specialised treatment plants, or on-site with mobile installations. The treatment options include thermal treatment, soil washing, as well as biological and chemical treatment.

Hydraulic Measures

Contaminants that have migrated into the ground may occur in four phases: as free product, as gaseous phase, as sorbed phase bound to the soil particles and as aqueous phase dissolved into the pore water. An immiscible free product is referred to as non-aqueous phase liquid (NAPL). With hydraulic measures pollutants that are in contact with groundwater can be eliminated. Since artificial hydraulic regimes can be created with extraction and injection wells, as well as with surface infiltration systems, hydraulic measures have been proposed to tread all contamination phases except the gaseous phase. With hydraulic measures a contaminated aquifer can be remediated by extracting groundwater in such a way that the contamination hot spot is flushed and further spreading of the contamination plume is halted. The extracted water can either be pumped to a municipal wastewater treatment plant or treated on-site with mobile installations, if an off-site treatment facility can not be accessed or the wastewater would be too toxic. Another option of hydraulic remediation is the installation of reactive walls, which are passive decontamination elements installed downstream of the contamination source in the polluted aquifer. Two principal approaches can be distinguished: permeable reactive walls and funnel-and-gate systems. The basic idea of a funnel-and-gate system is the introduction of vertical barriers that guide the contaminated groundwater like a “funnel” to a permeable reactor where the contamination is degraded or immobilised (Starr & Cherry 1994). The barrier itself does not have to be completely impermeable; a permeability contrast of 1/1000 to 1/10000 has proven to be already sufficient to achieve the funnelling effect. Permeable reactive walls, on the other hand, are constructed without guiding barriers since the degradation and/or immobilisation function is executed at the full length of the wall.

In-situ bioremediation

Bioremediation can be defined as the use of microorganisms to control and destroy contaminants by employing microbiological degradation processes (NRC, 1993). This applies usually only to organic contaminants. The technology has been proven successful, especially when applied to hydrocarbon contamination like gasoline, diesel, and oil spills typical for filling station, oil storage facilities, and airforce bases. Bioremediation techniques are ecoefficient because they hardly consume resources - the main task is effectuated by microbes - and produce almost no waste since the contaminants are biotransformed into daughter products (metabolites) and finally "mineralised" into carbon dioxide, water, and inorganic residues. Biodegradation measures do not (or only temporarily) disturb the natural groundwater flow and preserve the resource "soil". The remediation success can easily be monitored by observation wells. Biodegradation is, however, restricted to permeable, granular soils. Inhomogeneities in the ground may cause preferential migration path for biodegrading agents. The clean-up time may be rather long, especially in the case of passive bioremediation measures. Only organic contaminants can be treated and attention has to be paid to the formation of toxic metabolites during the degradation process.

Phytoremediation

Plants can be used as a low cost-low alternative to decontaminate or render innocuous organic or inorganic contaminants in water or soils. They can be applied to a variety of pollutants including metals, hydrocarbons, polychlorinated biphenyls, chlorinated solvents, nutrients (nitrates, ammonium, phosphates), pesticides, explosives and radionuclides (Miller 1996). Phytoremediation is based on two main approaches, which are phytodecontamination (extraction of contaminants) and phytostabilisation (restriction of mobility of contaminants) (Cunningham et al. 1996). The many different plants that can be used have to be tolerant to the contaminant, adapted to the local conditions, easy to handle and to dispose of. After remediation work, the harvested plants may be utilised for energy production (incineration, biogas production) or as construction material or for other non-food products. In fact, many parameters govern the overall remediation success including the contamination pattern (types, combination, distribution) the growth rate and the biomass production, contaminant concentrations in plant tissues, and agronomic characteristics of the plants. The technology of phytoremediation has a number of advantages including the utilisation of solar radiation as energy source, the preservation of the natural soil conditions, the applicability to large surfaces and the low costs to implement the technique. On the other hand, the biomass has to be harvested and processed further. A long treatment time – usually more than one planting period, i.e. many years - is required. The remediation depth is limited to about one meter, although deep-rooted trees such as poplars may reach greater depth. Furthermore, since the contaminants accumulated in the plants, they may enter the food chain via animals (especially insects) that feed on them.

Natural Attenuation, Intrinsic Bioremediation and Flexible Response

There are cases where a certain contamination may be tolerated for the time being since neither humans nor resources are threatened. For instance, the source may be located way underneath the surface, inaccessible for playing children or plant roots. The groundwater contaminated by the source is not used as drinking water. In these cases, a close observation of the contamination source and its vicinity may be sufficient. With time, the contamination may be diluted. Furthermore, naturally occurring microbes slowly degrade organic pollutants. These processes are referred to as *natural attenuation* and *intrinsic bioremediation*. Although intrinsic bioremediation can be considered a low budget solution, the time needed to reduce the contamination can be extensive.

Consideration of former use to mitigate disasters (Susanne Hauser)

Systematic observations of mine subsidence, water retention facilities including dikes and pumps, and control devices for mine gas monitoring are among the common practices in mining districts. The conditions of the soil, water, and air can only be stabilized and safeguarded through more or less costly measures depending on the given situation. Unlined slag heaps pose hazards, land subsidence may occur unforeseeably only anticipated upon a "suspicion", water canalization frequently accompanied by extensive impacts often has to be continued long after the mining has ceased in the region sometimes just to save significant nature conservation areas from destruction as in the case of the partly active brown coal mining district of Lausitz to save the Spreewald.

In the Emscher district, for example, even after most of the mines were closed, 800 pumps prevent the area from being swamped or bogged as once happened in the mid-19th century when land subsidence occurred as a result of underground engineering in the large coal mines. Today gas drainage facilities help to control the vapors from dumps and toxic waste disposal sites and to prevent fires or explosions. The transformation of the former floodplain area of the Emscher, first to enable mining and later caused by the impacts of mining, has lead to a permanent compulsion for control and care of wastes.

The results of negligence and the lack of care in the disposal of wastes lead to the first area-wide remedial activity that first dealt with safeguarding and then with the refurbishment of old industrial land. In October 1966 after giving up mining, a neglected slag heap became dislodged just above the Welsh village of Aberfan. Several houses and the village school were submerged in the rubble. 144 people died, most of them children less than eleven years old. Ever since, there is hardly a book on the recycling of relinquished land that does not mention the Aberfan disaster in their introductory passages.

Permanent noticeable damages of this kind were treated as local events and isolated occurrences well into the 60s of the last century, and the correlated impacts were regarded as unintentional and fateful incidents that could not, or only in rare cases could be attributed to failures in responsibility. They were interpreted as "misfortunes", and no expert debates, let alone public ones, brought up the subject of toxic substances or land subsidence. The Aberfan disaster, however, had an alarming effect. The land-sliding slag heap triggered off a massive allocation of funds to refurbish old industrial land in Great Britain. The "misfortune" did not only bring the issue of safeguarding slag pits to attention, but also highlighted the living conditions in the coal mining areas of South Wales, a region which had already lost its economic significance at this point. Shortly after the disaster, the government initiated the first comprehensive program in Europe to safeguard relinquished industrial land and make it fit for reuse.

Through the Local Government Act of 1966, funding for refurbishment was no longer only confined to a few sites or regions, but also enforced the refurbishing of old industrial land by allocating derelict land grants to communities all over Great Britain. Mechanical safeguarding and aesthetic considerations were the main issues of concern here.

The first reclamation schemes of the 1960s and 70s, however, did not enjoin any detailed soil surveys or any other kind of chemical examinations of the various locations concerned. Contaminants, which had become a new subject for debate about problematic industrial sectors in the 1970s, were either overlooked, covered up, buried upon discovery, removed, or distributed and diluted. It was not until later, after supposed land recovery, that water occasionally happened to wash out undesirable substances which had not been considered previously, so that follow-up remediation schemes had to be initiated on the respective sites. Today impacts of this kind emerging from old garbage dumps and buried barrels with unexamined content are regarded as unpredictable (refer to Richards, 1995).

Consideration of former use to develop aesthetic redevelopment strategies (Susanne Hauser)

Land use planning and landscape design aim at confining areas with restricted usability to types of utilization that have low requirements: Parks are developed on contaminated soils or areas with suspected contamination; or in even more serious cases, parking lots, green open spaces, or "green areas with prohibited access" are planned. The urban planning term for this is "undemanding use".

The political weighing off minimum ecological standards against maximum economic costs, which had in the meantime become indispensable due to the extensive findings and the public discussion of dangerous wastes from the past, defines the scope for decision-making on remediation and subsequent use. One of my colleagues most poignantly described the pragmatic treatment of registered areas of contamination that cannot be cleaned up as the compulsion to develop "waste-based land use concepts".

The attempt to establish a safeguarding limit and, in turn, to assign a piece of land or soil to each use, or also the concept of only utilizing sites with restrictions according to a precisely scaled and graded assessment and thus granting contaminants special locations or zones assigned to them is an organized, controlled, scaled, and well-defined retreat in dealing with the issue of wastes.

This way of dealing with the residues of past industrial production has special implications on the general assumptions concerning the future of a site and its controllability. Thus a model of the environment is projected that regards extensive controlling of the state and utilization of such sites to be a necessary requirement. Among these requirements are the necessity to continuously control and monitor building sites through competent institutions capable of this task and to guarantee that their future utilization is thoroughly reflected with respect to dangerous wastes from the past and the nature of future land developments.

It is also required that the necessary information as well as the systems of reference and interpretation leading to the current assessment are available to safely enable any future utilization and that all those intending to use the site in a certain way have access to this knowledge. Another requirement is that the entitlement to this knowledge is not put to the test, that the prevention of hazard-prone use is possible, in other words, that violations can be sanctioned, and finally, that no possible circumstance may lead to prescribing a use of the site that contradicts the defined restrictions. The decisions on uses deemed possible are not determined by individual urban or landscape planners, but are interpreted as necessary requirements for the further development of a new environmental model for the used location.

Some design conceptions, however, respond to the restricted use or also to the complete separation of otherwise untreatable wastes with a symbolic treatment of the matter. Others emphasize the relatively new insight in the history of waste management that there are substances which never, or only after a very long time, lose their hazardous potential, and thus they take reference to a historically new dream that became conceivable and necessarily conceived for the first time in the course of the debate on nuclear wastes: It is the dream of being able to encapsulate toxic wastes within everlasting bounds, establishing permanent forms of waste disposal sustainable through time and throughout the ages, and thus forming lasting barriers and durable entrenchments against xenobiotica or lethal substances of any kind.

The techniques adopted by design conceptions dealing with refuse, waste, and finally, with well-defined dangerous wastes from the past in a symbolic, virtual, or actual manner are quite diverse. These are described in the following parts of the lecture. They are strategies to enhance and confirm the visibility of that which is disposed of, while at the same time organizing the disappearance of that waste. All these in the widest sense aesthetic approaches and strategies of symbolically exploiting and destroying waste are deployed in order to finally, or at least for the time being, cope with wastes defined as dangerous wastes from the past or instances of contamination.

Remark

… The ideas presented in Dieter Genske’s texts are developed in more detail in Genske (2003).

… The ideas presented in Susanne Hauser’s texts are developed in more detail in Hauser (2001).

References

Anon. (1998) Sustainable development Germany (in German). Governmental program, Berlin

Bonberg, W, Sobich PR (1995) Revitalisierung brachgefallener Hüttenstandorte im Saarland. BrachflächenRecycling/RecyclingDerelictLand 1/95: 47-52

Cunningham SD, Anderson TA, Schwab AP, Hsu FC (1996) Phytoremediation of soils contaminated with organic pollutants. Advances in Agronomy 56: 55-95

Ferber U (1995) Land recycling in Europe: strategies and recommendations (in German). Flächenrecycling Brownfields Redevelopment 1/95: 14-18

Freier K et al. (o.J.) Vorgaben des Bundes-Bodenschutzgesetzes für das Flächenrecycling. Manuscript.

Genske DD (2003) Urban Land: Degradation – Investigation – Remediation. Spinger, Berlin Heidelberg New York. 333p

German Council of Experts for Environmental Issues (Rat von Sachverständigen für Umweltfragen, 1990) Altlasten: Sondergutachten, Stuttgart

German Federal Department of the Environment (Bundesumweltministerium, 1994) Ökologischer Aufbau. Altlastensanierung. Eine Information des Bundesumweltministeriums, Berlin

Hauser S (2001), Metamorphosen des Abfalls. Konzepte für alte Industrieareale, Frankfurt/M., New York

Lühr HP (1996) Editorial. Fünf Jahre ITVA. altlasten spectrum 5,1/96: 1

Miller RR (1996) Phytoremediation. Technology overview report TO-96-03, Groundwater Remediation Technologies Center Pittsburgh

NRC (1993) In situ bioremediation: when does it work? Report US National Research Council National Academy Press, Washington DC, 206 p

Richards IG (1995) European approaches to derelict land reclamation – Experience in Wales. European Academy of the Urban Environment (ed.) Redevelopment of derelict land in Europe, Berlin: 23-29

RSU (2000) Environmental report (in German). Report of the German Rat von Sachverständigen für Umweltfragen, Wiesbaden

Starr RC, Cherry JA (1994) In-situ remediation of contaminated ground water: the funnel-and-gate system. Ground Water 32/3: 465-476