Leaching Characteristics of Recycled Asphalt Pavement: RAP May Be Suitable As a Fill Material

Prepared by Ken Winter, December 2006

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KEY SEARCH TERMS:

Recycled Asphalt Pavements (RAP)

Milled Asphalt

Leachate

Leaching

Toxicity

Fill Material

Research Synthesis Bibliography No. 4

Research Synthesis Bibliographies (RSBs) are distillations of relevant transportation research on current topics of interest to researchers, engineers, and policy/decision makers. Sources cited are available for loan (or available through Interlibrary Loan) to VDOT employees through the VDOT Research Library.

Recycled Asphalt Pavements (aka Milled Asphalt) May Be Safe to Use as Fill

Milled Asphalt (frequently referred to as Recycled Asphalt Pavement…or RAP) is commonly mixed with Hot Mix Asphalt and re-used in paving projects. However, some research has been conducted on the feasibility and potential environmental impact of using milled asphalt as fill material for bridge approaches and similar applications.

Even when used in applications above mean high water (an unsaturated condition), concern has been expressed that lechate resulting from flood or rainfall could be contaminated by such recycled asphalt and thus have negative environmental consequences.

Results of numerous field studies and standardized tests, including the Toxicity Characteristic Leachate Procedure (TCLP) test, suggest that typical RAP can be used as "clean fill" without undue negative environmental consequences. However, it may be useful to contact one of several preeminent researchers in this area to discuss the matter directly.

1. Anthony J. Kriech
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2. Timothy G. Townsend
University of Florida, Office #333 NEB, P.O. Box 116450, Gainesville, FL 32611-6450,
ttown@ufl.edu, (352) 392-0846,
http://www.ees.ufl.edu/directory/faculty/template.asp?KeyName=Townsend

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OVERVIEW

Research Synthesis Bibliographies (RSBs) are selected lists of resources on current topics of interest to VDOT employees or divisions. When available, links to online documents are provided.

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GETTING RESOURCES LISTED HERE

Full text copies of most resources listed in this document are available in the VDOT Research Library's collections, or through Interlibrary loan, through the Library. In many cases, the Library owns both virtual and hard copies of documents, as well as formats such as CD-ROM.

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Application Of Recycled Waste Aggregate To Lean Concrete Subbase In Highway Pavement

CITATION: Y. -H Cho and S. -H Yeo. , Canadian Journal of Civil Engineering, 2004. Vol. 31, No. 6, Pg. p. 1101-1108.

ABSTRACT: As aggregates recycled from various types of construction waste are continuously being produced, interest has focused on how to apply them for use in highway pavement. This paper considers the application of waste aggregates to lean concrete, based on basic mechanical property tests and environmental toxicity. Compared with natural aggregates, waste aggregates derived mainly from recycled concrete have low specific gravity and high water absorption characteristics. After testing their environmental toxicity, it was found that waste aggregates do not release any metallic ions when introduced to alkaline conditions but do release a small but seemingly harmless amount of metallic ions when introduced to acidic solutions. Concrete made with waste aggregates has significant limitations in strength, particularly flexural strength, which is the main parameter of quality control and design for concrete pavement. It is therefore not practical to use waste aggregates for the surface layer of concrete without using additives or special treatments. It is possible, however, to apply concrete with waste aggregates for lean bases. In testing, lumps of asphalt, cement paste, bricks, and glass were classified as impurities and were observed for changes in strength based on the percentage of impurities used. If the amount of impurities is greater than 25%, the 7-d compressive strength does not meet the strength requirements specified for lean concrete. (c) 2004 NRC Canada.

ACCESS: Available to VDOT employees through Interlibrary Loan.

Asphalt Leachability Studies

CITATION: Anthony J. Kriech. , 1990-1992.

ABSTRACT: Evaluation on hot mix asphalt for leachability--Evaluation of rap for use as a clean fill--Leachability of aspalt and concrete pavements--Leachabilty of cold mix asphalts.

ACCESS: Available to VDOT employees through Interlibrary Loan.

Asphalt Tests Show Little Leachate

CITATION: Civil Engineering, Vol. 68, No. 11. November 1998. Pg. 32.

ABSTRACT: Reclaimed asphalt pavement (RAP) does not leach toxic materials into the ground and could be used as construction fill, according to a study conducted by University of Florida researchers. The study helps refute theories that RAP piles at asphalt plants pollute groundwater and gives contractors more options for using the material. Researchers passed water through samples from six sites in Florida and then compared the filtrate with data from U.S. Environmental Protection Agency toxicity tests. The results revealed no toxic organic material but did identify low levels of lead in the water, probably from leaded gasoline that had soaked into RAP harvested from older roads. Note: Description: p. 32.

ACCESS: Available to VDOT employees through Interlibrary Loan.

Assessment Of Water Pollutants From Asphalt Pavement Containing Recycled Rubber In Rhode Island

CITATION: Raymond M. Wright, Rhode Island and Dept. of Transportation, et al. , 1999. Note: Note(s): "December 15, 1999."/ Includes bibliographical references./ Funding: Performed by the Dept. of Civil and Environmental Engineering and the Graduate School of Oceanography of the University of Rhode Island for Rhode Island Dept. of Transportation Research and Technology Development under contract no./ Contract No: SPR-223-2225.

ACCESS: Available to VDOT employees through Interlibrary Loan.

Decision Analysis for Storage for Reclaimed Asphalt

CITATION: Jenny Norrman, Lars Rosén and Malin Norin. , Environ.Eng.Sci., 2005. Vol. 22, No. 6, Pg. 783-801.

ABSTRACT: Hydrogeological decision analysis was used to compare five alternative designs for temporary storage of reclaimed asphalt pavement (RAP) with respect to the environmental economical risks to groundwater and the construction costs. The study was generic in scope and directed at RAP storage in gravel pits in glacio-fluvial deposits. This hydrogeological setting constitute the major aquifers for public water supply in Sweden, and storing RAP in this setting may therefore impose conflicts with groundwater protection and supply interests. The decision analysis considered the contaminant load on the hydrogeological system, the subsurface contaminant transport conditions, the environmental economical risks of contamination above existing compliance levels, and the construction costs of the facility. A sensitivity analysis was done with regard to the costs, the cover efficiency, and the model uncertainty. Risk was defined as the expected costs of failure to meet existing compliance levels, and the objective of the study was to identify the alternative that minimizes the sum of investment and risk costs at a typical RAP site. Field measurements identified chloride, lead, and butylated hydroxytoluene (BHT) as major contaminants. Stochastic transport simulation for a typical glacio-fluvial sand and gravel aquifer indicated that lead and BHT pose little risk to this hydrogeological setting, but that chloride has a stronger impact. The decision analysis showed that a simple cover to prevent leachate production is the most cost-effective design for small- to medium-sized glacio-fluvial aquifers. It further showed that unmonitored RAP storage should be avoided for large aquifers.

ACCESS: Available to VDOT employees through Interlibrary Loan.

Determination of Polycyclic Aromatic Compounds in Asphalt and in Corresponding Leachate Water

CITATION: A. J. Kriech, J. T. Kurek and L. V. Osborn, et al. , Polycyclic Aromatic Compounds, 2002. Vol. 22, No. 3-4, Pg. 517-535.

ACCESS: Available to VDOT employees through Interlibrary Loan.

Developing Specifications For Using Recycled Asphalt Pavement As Base, Subbase Or General Fill Materials, Phase Ii

CITATION: Cosentino, P J Kalajian, E H Shieh, C-S Mathurin, WJK Gomez, F A Cleary,E.D.Treeratrakoon, A. ,

ABSTRACT: This Phase II work focused on 1) validating the Phase I developmental specifications for using Recycled Asphalt Pavement (RAP) as a base, subbase or general fill, 2) evaluating the strength gain of RAP within the first two months after construction, 3) evaluating RAP-Soil mixes in the laboratory, and 4) evaluating the environmental performance of RAP in the field. The Phase I Developmental Specifications were updated to allow RAP as a subbase below rigid pavements. A second field site was constructed using RAP and a Limerock control section. It included surface water and leachate water collection systems in both the RAP and Limerock. The initial strength gains were evaluated over an 8-week period and the environmental performance was analyzed over 12 months. Construction with RAP was equivalent to or better than construction with Limerock. RAP's strength-deformation behavior increased throughout the 8-week study period based on field California Bearing Ratio (CBR) data converted to Limerock Bearing Ratio (LBR), Initial Stiffness Modulus (ISM) values from the Falling Weight Deflectometer (FWD), and stiffness values from both the Clegg Impact Hammer and the Soil Stiffness Gage (SSG). LBR, Clegg and ISM data indicated that RAP experienced a 50% strength gain over 8 weeks while the SSG results indicated that the

strength gain was 15%. The Clegg, FWD and SSG testing also indicated that RAP stiffness was similar to Limerock. RAP-Soil mixes were evaluated by adding varying percentages of a poorly graded sand with clay, an A-2-6 (SM-SP) soil dredged from the Turkey Creek area in Palm Bay, Florida. The 80% RAP-20% soil mix produced the most desirable engineering behavior. Preliminary creep testing indicated that both the 100% RAP and the 80/20 RAP-Soil mix may pose long term deformation concerns. The environmental evaluation indicated that RAP poses no environmental concerns when used as a highway material. The concentrations of heavy metals were well below the EPA standards. Samples were taken over a 12-month period and subjected to four different environmental testing procedures. All four yielded the same conclusions, indicating that the testing program was valid. Note: Period Covered: 0011-0304; Description: 271 p.; Appendices(12); Figures; Photos; References; Tables.
ACCESS: http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_SMO/FDOT_BC819_rpt.pdf

Environmental Impact Of Crumb Rubber Asphalt Concrete Leachate Contaminants From Highway Construction And Repair Materials On Surface And Ground Waters
CITATION: M. F. Azizian, P. O. Nelson and P. Thayumanavan, et al. , National Meeting-American Chemical Society Division of Environmental Chemistry, 2001. Vol. 41, No. 1; PTS 2, Pg. 409-413.
Note: Name: American Chemical Society; Division of Environmental Chemistry; Preprints of extended abstracts presented at the 221st ACS national meeting.
ACCESS: Available to VDOT employees through Interlibrary Loan.

Formulation Of Mix Design For Asphaltic Incorporation Of Hydrocarbon Contaminated Soil
CITATION: R. A. Tarefder, M. E. Ruckgaber and M. Zaman, et al. , Journal of Materials in Civil Engineering., 2003. Vol. 15, No. 2, Pg. 166-173.
ABSTRACT: A cold mix design procedure was developed to incorporate hydrocarbon-contaminated soil as an ingredient of pavement base-product. The incorporation was achieved by asphaltic stabilization and encapsulation utilizing cold mix asphalt technology. The main focus is to maximize the soil in economically viable end products that meet industry standards, engineering requirements, and environmental safety requirements. Mix design was performed by several trials based on bench-scale parameters. Aggregate from a local quarry was used as one of the ingredients of mix to reduce end product cost. Soil and aggregate, prior to their incorporation, were assessed for their suitability for use in the stabilization process by bench-scale tests such as particle size distribution, sand equivalent, plasticity, density, and specific gravity. Varying amounts of affected soil, aggregate, a small amount of portland cement, and specified grades of emulsion were mixed, compacted, and tested for resistance and tensile strength. Leachate testing of the engineered product for total hydrocarbon ensured its use in a pavement base. The formulated mix design incorporated 80% of the hydrocarbon-affected soil by weight of soil-aggregate mix. Incorporating a higher percent of soil in the mix can lose the economic incentive because of the increased cost of emulsion. Note: Country: United States; Additional Info: United States; References: Number: 33.
ACCESS: Available to VDOT employees through Interlibrary Loan.

Investigation Of Heavy Metal Leachability From Boiler Aggregate Amended Asphalt Concrete
CITATION: Amit Oturkar. , 2001. Note: Note(s): Typescript./ Includes bibliographical references./ Dissertation: Thesis (M.S.)--University of Massachusetts. Lowell, 2001.;

Responsibility: by Amit Oturkar.; Entry: 20021106; Update: 20030416.
ACCESS: Available to VDOT employees through Interlibrary Loan.

An Investigation Of Water Quality In Runoff From Stockpiles Of Salvaged Concrete And Bituminous Paving
CITATION: Roger W. Sadecki, Minnesota and Dept. of Transportation, et al. , 1996. Note: Note(s): "September 1996."/ Includes bibliographical references./ Report: MN/PR-96/31; General Info: Final report./ 1993-1994.; Responsibility: prepared by Roger W. Sadecki ... [et al.].; Entry: 19970214; Update: 20020430.
ACCESS: VDOT Research Library, Call Number: TD 428 .R84 I58 1996

Leaching Characteristics of Asphalt Road Waste
CITATION: Timothy G. Townsend.
ABSTRACT: Discusses milling for reclaiming asphalt road waste and the agency-imposed limitations (perhaps unnecessary) of using Reclaimed Asphalt Road Pavement (RAP) primarily for recycling back into new Hot Mix Asphalt. The author contends that RAP can be used as a fill material without undue concern for leaching. Discusses a project conducted to address these specific environmental concerns. Note: This technical paper was excerpted from an article originally published in HMAT in Winter 1998, Volume 3, Number 4.
ACCESS: www.hinkleycenter.com/publications/townsend_98-2.pdf

Leaching Characteristics of Asphalt Road Waste
CITATION: Timothy G. Townsend. , 1998.
ABSTRACT: Data regarding the composition of leachate from Recycled Asphalt Pavement (RAP) is limited. This paper suggests that RAP can be used as construction fill or in embankments. It has been suggested that heavy metals or polycyclic aromatic hydrocarbons (PAHs) might be present in RAP and may therefore leach from it given the proper circumstances. An investigation performed to address these concerns found that, based on waste management policy in Florida, the RAP tested in this study would result in exceeedences of groundwater guidance concentrations of the pollutants studied.
ACCESS:
http://www.wilderconstruction.com/pdfs/MatCon%20Leaching%20Technical%20Paper.pdf

Leaching Characteristics of Asphalt Road Waste
CITATION: T. G. Townsend. , HMAT, HOT MIX ASPHALT TECHNOLOGY, Vol. 3, No. 4,
ABSTRACT: A proposed alternative for the management of reclaimed asphalt pavement (RAP) is use as fill material. However, two different types of environmental concerns relate to leaching of pollutants from RAP. The first is that the leachate produced when rainfall infiltrates RAP stockpiles could potentially be contaminated with trace amounts of organic compounds or heavy metals. A second environmental concern is that RAP used a fill material could potentially leach off contaminants when rainfall infiltrates the waste (unsaturated condition) or when used as fill below the water table (saturated condition). In both situations, the leachate produced could potentially be contaminated with trace amounts of the hazardous chemicals. Thus, a series of leaching tests were performed in Florida at both batch-scale and in leaching columns. The primary chemicals investigated were volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and heavy metals. Results were consistent with previous studies showing that organic compounds do not leach from typical RAP. Heavy metals are sometimes encountered. The literature indicated the presence of chromium, lead, and barium; however, only lead was detected in this study and was ascribed to prolonged

exposure to traffic and vehicle emissions. Results indicate that in most cases RAP would pose minimal environmental risk when used as fill in regard to the leaching of pollutants.
ACCESS: Available for Checkout from the VDOT Research Library

Leaching of Pollutants from Reclaimed Asphalt Pavement
CITATION: A. S. Brantley and T. G. Townsend. , Environmental Engineering Science, 1999. Vol. 16, No. 2, Pg. 105-116.
ABSTRACT: The construction and expansion of asphalt roadways results in the production of a large amount of milled asphalt also known as reclaimed asphalt pavement (RAP). A major fraction of this RAP is recycled by incorporation into a new asphalt mixture. At times, however, a large amount of this material may require other forms of management. One proposed alternative for the management of RAP is use as fill material. A limitation to using RAP as fill material stems from unknown risks of pollutants leaching from the waste to the environment. Research was conducted to address some of the environmental concerns related to the possible leaching of pollutants from RAP. Six samples of RAP was collected from asphalt plants throughout Florida. A series of leaching tests were performed at both batch-scale and in leaching columns. The primary chemicals investigated were volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and heavy metals. Results from the Toxicity Characteristic and the Synthetic Precipitation Leaching Procedures (both batch tests) indicated that the RAP samples investigated were not a hazardous waste and did not leach chemicals greater than typical groundwater standards. Leachate collected during the column studies did not contain levels of PAHs, VOCs, or selected heavy metals (Ba, Ca, Cr, Cu, Ni, and Zn) above typical groundwater regulatory concentrations. In RAP from older roadways, lead was detected in amounts slightly above the primary drinking water standard (15 mu g/L), but the concentration diminished over time.
ACCESS: Available to VDOT employees through Interlibrary Loan.

Mitigating Nutrient Leaching With A Sub-Surface Drainage Layer Of Granulated Tires
CITATION: R. D. Lisi, J. K. Park and J. C. Stier. , Waste Management, 2004. Vol. 24, No. 8, Pg. 831-839.
ABSTRACT: Markets for scrap tires have expanded since the early 1990s with the development of value-added applications such as tire-derived fuel and crumb-rubber-amended asphalt. Granulated tires have also displayed the ability to adsorb volatile organic compounds, indicating that the rubber material can be a useful filter media. Sand-based root zones, typically used for golf course putting green and athletic field construction, lack sufficient cation exchange capacity to restrict nitrogen and phosphorus migration through the root zone and into sub-surface drainage systems. Therefore, the adsorptive properties of tire rubber for retaining nitrogen and phosphorus were studied when applied as a distinct sub-surface drainage or intermediate layer in golf course putting greens. A statistically significant reduction in the concentration of nitrate in leachate was achieved by replacing traditional pea gravel with equally sized granulated tires for the drainage layer media, although the mechanism of nitrate mitigation remains unclear. The results indicate that using granulated tires as a drainage layer or fill material beneath sand-based root zones does not compromise the function of the profile or quality of the vegetation while creating an environmentally beneficial and value-added option for scrap tire reuse.
ACCESS: Available to VDOT employees through Interlibrary Loan.

Physical And Environmental Properties Of Asphalt Mixtures Containing Incinerator Bottom Ash

CITATION: C. -M Huang, W. -F Yang and C. -T Chiu, et al. , Journal of Hazardous Material, 2006. Vol. 137, No. 3, Pg. 1742-1749.

ABSTRACT: This paper presents parts of the results from a research project sponsored by Taiwan Environmental Protection Administration (TEPA), investigating both the physical and environmental properties of asphalt mixtures using different amount of incinerator bottom ash (IBA) as fine aggregate substitution. The Marshall mix design method was used to determine the design asphalt content and evaluate the potential performance of these IBA-asphalt mixtures. Water sensitivity and wheel track rutting were also performed on these mixtures. Leachates, from both laboratory and outdoor leaching tests, were performed to measure the concentration of selected heavy metals and the level of daphnia toxicity. While with adequate Marshall Stability, the IBA-asphalt mixtures were shown to have excessively high Marshall flow and excessively low VMA (voids in the mineral aggregate). The results of the wheel tracking tests also indicated that the IBA-asphalt mixtures had low rutting resistance. The results of the water sensitivity test according to procedure of AASHTO T283 method showed that the IBA-asphalt mixtures had a higher tensile strength ratio (TSR) as compared with the conventional asphalt mixtures. Considering the environmental aspects, outdoor leaching tests showed that IBA had a high level of daphnia toxicity. From an ecological perspective, IBA could be identified as hazardous waste in Taiwan. However, after being mixed with asphalt binder, the concentration of heavy metals and the levels of daphnia toxicity were significantly reduced. The leachates of 10-day flat plate leaching tests on Marshall specimens containing IBA indicated that the heavy metal were undetectable and the daphnia toxicity was ineffective.

ACCESS: Available to VDOT employees through Interlibrary Loan.

A Qualitative Assessment Of The Toxic And Mutagenic Activity Of Road Paving Asphalts

CITATION: Sherry Lynn Henry Gage. , 1990. Note(s): Includes bibliographical references (leaves 78-84)./ Dissertation: Thesis (Ph. D.)--University of Oklahoma, 1990.

ACCESS: Available to VDOT employees through Interlibrary Loan.

Relating Batch And Column Diffusion Coefficients For Leachable Contaminants In Particulate Waste Materials

CITATION: V. O. Ogunro and H. I. Inyang. , Journal of Environmental Engineering, 2003. Vol. 129, No. 10, Pg. 930-942.

ABSTRACT: For constructed facilities in which waste materials are used as partial substitutes for traditional aggregates, it is usually necessary to perform contaminant leachability tests to assess the long-term emission of contaminants from the facilities during service. Such tests can be performed under batch and column flow-through conditions. It is usually desirable to establish the relationship between leached contaminant concentrations obtained through both tests. Using Al and Cu diffusion coefficients as the target parameter, an analytical model is developed and presented herein with experimental data from acidic solution (pH of 4.5) leach testing of asphalt concrete that was amended with municipal solid waste incinerator bottom ash in weight percentages ranging from 0 to 20 to assess the equivalence of both sets of leaching conditions. The results for Al show that at higher column flowrates indexed by Peclet numbers in excess of 5.5, there is no defined relationship between Al diffusion coefficients obtained through both methods. Fluid flow at lower Peclet numbers approach batch conditions and afford an opportunity for the use of the analytical model presented in this paper provided comparisons are made at equivalent liquid/solid ratios. The values of the batch diffusion

coefficients obtained for Al are of the order of 10-10-10-6 cm2/s. For column leaching of Al, the range is 10-8-10-7 cm2/s. No measurable quantity of Cu was obtained under both batch and column leaching conditions.
ACCESS: Available to VDOT employees through Interlibrary Loan.

Remediation Of Chromium-Contaminated Soils: Bench-Scale Investigation
CITATION: J. N. Meegoda, B. A. Noval and R. T. Mueller, et al. , Pract.Periodical Hazard., Toxic, Radioact.Waste Manage., 1999. Vol. 3, No. 3, Pg. 124-131.
ABSTRACT: A feasibility study was performed to remediate chromium-contaminated soil by cold top ex situ vitrification. This paper describes the initial conceptualization of the research demonstration and the results from the bench-scale study. Hexavalent chromium is a well known Group A human carcinogen. There are more than two million tons of leftover chromite ore residues from chromate extraction manufacturing in Hudson County, New Jersey. They contain both unleached haxavalent and unoxidized trivalent chromium. Both forms are considered an environmental and health hazard. In this demonstration study, the cold top ex situ vitrification process was used to remediate the chromium-contaminated soils. This technology evolved from the glass melting industry. Here, the chemical chromate is reduced and immobilized in a siliceous matrix. The bench-scale study included site selection, lab-scale vitrification, physical and chemical characterization of contaminated soils and vitrified soil, evaluation of potential reuse of vitrified soils as construction aggregates, and selection of two potential sites for pilot-scale testing. Nine chromium-contaminated sites were selected for this bench-scale study. The total chromium concentration in soil from the above sites ranged from 0.2 to 2.6% by weight, and the hexavalent chromium in toxicity characteristics leaching procedure (TCLP) leachate was above 30 ppm in some sites. The lab-scale vitrified soils had hexavalent chromium in TCLP leachate below 5 ppm, the regulatory limit, and could be used as construction aggregates. The pilot-scale test performed from soils obtained from two of the above sites demonstrated the cold top ex situ vitrification technology and the potential reuse of vitrified soil in highway construction application as asphalt concrete. Note: Country: United States; Additional Info: United States; References: Number: 14.
ACCESS: Available To VDOT Employees Through Interlibrary Loan.

Stabilization/Solidification Of Galvanic Sludges By Asphalt Emulsions
CITATION: V. Bednarik, M. Vondruska and M. Koutny. , Journal of Hazardous Materials, 2005. Vol. 122, No. 1-2, Pg. p. 139-145.
ABSTRACT: A combination of two-aqueous asphalt emulsions was proposed for stabilization/solidification treatment of galvanic sludges prior to landfilling. The presented procedure comprises mixing the galvanic sludge with a slow setting nonionic asphalt emulsion and subsequently forming a secondary asphalt barrier by means of a rapid setting anionic asphalt emulsion. The method was tested on four samples of galvanic sludge from various galvanizing plants, with various water and pollutant contents. Stabilization efficiency was assessed by water-leaching test, TCLP test and by determining ecotoxicity of leachates. Leachate parameters exhibited very low values and favorable results of ecotoxicological tests indicate high efficiency of the developed procedure for galvanic sludge disposal.
ACCESS: Available to VDOT employees through Interlibrary Loan.

Stabilization/Solidification Of Noncombustible Industrial Waste By Asphalt Emulsions
CITATION: M. Sild, M. Vondruska and M. Koutny, et al. , Pract.Periodical Hazard., Toxic, Radioact.Waste Manage., 2004. Vol. 8, No. 1, Pg. 2-6.

ABSTRACT: A procedure for stabilization/solidification of loose waste from the manufacture of Ni and Cd electrodes, which represents a nonutilizable and noncombustible hazardous waste, has been worked out. The procedure comprises solidifying the waste by means of an anionic slow-setting aqueous-asphalt emulsion with subsequent formation of an asphalt coating on the surface of solidified waste by spraying with an anionic rapid-setting aqueous-asphalt emulsion. This asphalt coating represents a secondary barrier against leaching of pollutants into the environment. Results of leachability tests with water (Czech Republic regulations) as well as with acetic acid (toxicity characteristic leaching procedure test, EPA) are evidence of the successful stabilization of given waste. Values of determined leachability parameters of test specimens prepared from stabilized waste are very favorable and, in addition, virtually the same as those of blank test. This demonstrates, in a convincing manner, efficiency of the developed stabilization/solidification procedure. Results have also shown the toxicity characteristic leaching procedure test is indispensable for the assessment of toxic metals leachability. Performed tests have shown a marked drop in ecotoxicity from relatively high toxicity of untreated waste leachate to low toxicity of stabilized waste leachate.
ACCESS: Available to VDOT employees through Interlibrary Loan.

Toxicity Of Milled Asphalt Pavement To Aquatic Organisms And Its Effects On Stream Substrates In Deep Creek, San Bernardino County

CITATION: King, Joseph T. Harrington, James M. Wagter,Kevin R., California and Dept. of Fish and Game, et al. , 1996. Note: Note(s): "March 1996"--Cover./ "Administrative Report #96-3"--Cover.; Responsibility: Joseph T. King, James M. Harrington, Kevin R. Wagter [California Department of Fish and Game].;
ACCESS: Available to VDOT employees through Interlibrary Loan.