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Metal and Precision Cleaning: Alternatives to Ozone Depleting Substances. Two of the major solvents used in cleaning will be banned worldwide over the next decade because they contribute to stratospheric ozone depletion. One of these, CFC-113, is a chlorofluorocarbon that is commonly used for precision cleaning applications. The other, 1,1,1-trichloroethane (TCA), is widely used for general cleaning applications. This paper describes the short-term options for minimizing the use of solvents and the long-term options for eliminating their use altogether. Short-term measures involve substituting TCA for CFC-113, using recycled rather than virgin solvent, making equipment modifications, purchasing better equipment, and recovering vapors. Long-term options involve substituting another chemical or process. Chemical substitutes include other chlorinated solvents, flammable solvents, combustible solvents, HCFCs, HFCs, and FCs. Process substitutes include aqueous cleaning supercritical carbon dioxide, carbon dioxide snow, UV/ozone, flash lamp, and laser techniques.

K. Wolf. Cited: Institute for Research and Technical Assistance Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991. PHOTOCOPY ORDER NUMBER: 199303-57-0365.

Replacing Perchloroethylene and Freon Degreasing With an Aqueous Cleaning System. This paper describes the substitution of halogenated solvents with various aqueous solutions used in rough and precision cleaning. The system described has been in use since 1987 and has completely replaced the perchloroethylene and freon 113 vapor degreasers as well as the various related flow and ultrasonic systems that used these solvents. The Aerojet Propulsion Division uses this process on various propulsion systems, including the Titan, Delta, and Space Shuttle. The cleaning of metal parts for liquid engines includes the removal of manufacturing soils as well as various post-fire residue. Ferrous and nonferrous alloys, coatings, and seals are cleaned with this process.

W.E. Spargo. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 477-483, [in English]. PHOTOCOPY ORDER NUMBER: 199303-57-0364.

VOC Compliance Through Paint Reformulation. To continue marine coating operations in areas with restrictive VOC regulations, the US Navy is reformulating current noncompliant paints. Five reformulated versions of the MIL-P-24441 coating system were applied to ASTM A-36 steel test panels blasted to near white metal and subjected to tests taken directly from qualification tests contained in current US Navy coating specifications. Of the tests conducted, two of the five reformulated versions of the coating performed better than the noncompliant control formulation. Results of the hot distilled water test and the ballast tank immersion test are reported.

J. Rudroff and R. Kogler Jr. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 456-462, [in English]. PHOTOCOPY ORDER NUMBER: 199303-57-0363.

Evaluating Alternatives to Chlorinated Solvents in Cleaning. Operations. Chlorofluorocarbons and chlorinated solvents are widely used in the aerospace industry for cleaning metal and electronic parts and systems. The production and use of these solvents must be phased out to comply with the Clean Air Act Amendments of 1990, the Montreal Protocol, and the provisions of the Resource Conservation Recovery Act (RCRA) and Superfund statutes (CERCLA). As a result, alternate cleaning chemistries are being investigated to replace these conventional cleaning solvents, and

processes are being developed and evaluated to minimize wastes and emissions. Several alternatives to chlorinated solvents already exist for degreasing and surface cleaning operations. These include hydrogenated chlorofluorocarbons (HCFCs) and aqueous and semi-aqueous cleaners. In the aerospace industry, the use of specific chlorinated solvents is often mandated by military specifications, thereby limiting the use of alternative cleaning agents. Therefore, case-by-case evaluation and testing is required to address the specific needs of a facility. Other waste minimization techniques, such as good housekeeping measures (e.g., maintenance of pumps and waste segregation), process modifications (e.g., covering vapor degreasers), and recovery/recycling techniques, can reduce emissions and the amount of waste that is generated. This paper introduces the regulations driving the need for waste minimization programs and alternate cleaners and focuses on how to identify appropriate waste reduction opportunities and solvent alternatives to achieve regulatory compliance.

K. Cook and C. Haretos. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 357-370, [in English]. PHOTOCOPY ORDER NUMBER: 199303-57-0362.

Waste Minimization and Disposal of Hazardous Wastes from Lead Paint and Coating Removal Projects. Prior to the late 1970s, most paint and coatings applied to steel structures contained heavy metals, such as lead, chromates, and zinc. Because of ever-increasing and more stringent regulations, most structures that were coated or painted prior to 1980 have been found to contain objectionable heavy metals. The State of California program for toxic and hazardous materials is covered under the California Administrative Code of Environmental Health, Title 22, Division 4. Under Title 22, coatings and paints are first tested to determine their toxicity. Once classified as toxic, the removed material and spent abrasive used in the removal process is again tested to determine if the materials need to be treated as hazardous waste. In most cases, the tests indicate that the removed coatings and paints mixed with the spent abrasive are hazardous. Under the recently enacted "Land Ban" regulations, the more stringent criteria for disposal has increased the cost for final disposal by more than 50%. The burdens inflicted on industry by ever-increasing regulations dictate the absolute necessity to expedite efforts to successfully meet new challenges of reducing costs in handling and disposal of hazardous wastes. This presentation offers suggestions to assist owners, engineers, specifiers, contractors, and others involved in barrier protection, via paints and coatings, in the use of alternative methods of surface preparation that are designed to reduce the quantities of hazardous wastes from such operations so as to minimize handling and disposal costs. W.B. Harper. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 351-356, [in English]. PHOTOCOPY ORDER NUMBER: 199303-57-0361.

Anodize and Prime Your Aluminum Without Environmental Headaches. Conventional procedures for surface finishing of aluminum are increasingly at odds with newer, more stringent regulations of VOC and chromate emissions. An alternative finishing method, resin-seal anodizing, provides a means of imparting corrosion resistance to the metal while producing no chromate or volatile emissions. The process uses traditional sulfuric acid anodizing, but modifies the final hydration step by using a resin-containing bath instead of the steam, water, or water solutions typically used. The resin particles are sized to fill the pore structure of the anodic film. The resulting resin-sealed surface acts effectively as a primed surface and can be used unpainted or topcoated. Not only is the process environmentally

friendly, it offers both weight and cost savings to the finished product. Resin-seal anodizing has been successfully used on the C-5 cargo aircraft and has recently been approved for use in selected C-130 aircraft applications.

R.L. Floyd Jr. and B.C. Maddock. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 335-346, [in English]. PHOTOCOPY ORDER NUMBER: 199303-57-0360.

Characterization of Low and Non-Volatile Organic Compound Containing Cleaners for Cleanroom Work Surfaces. This report presents an evaluation of low and non-volatile organic compound (VOC) containing cleaners intended for use as replacements for high VOC containing cleaners and solvents currently being used for bench-top and work station wipe down in many cleanrooms and clean areas. The evaluation studied cleaner residue, cleaner chemistry, and cleaner efficacy, including the ability to remove particles. Fifteen cleaners were selected for the evaluation, seven of which were specifically designed for use in cleanrooms. Isopropyl alcohol, methanol, and deionized water were included to provide a baseline for comparison. The cleaner evaluation was performed on coupons made from five different materials (PP, PVC, glass, formica, and nickel) representative of those typically used for work surfaces in Hughes Aircraft Company cleanrooms. Nine different contaminants representative of those expected to be found in Hughes' cleanrooms were used in the cleaner efficacy portion of the evaluation. Cleaner chemistry was determined by experimental methods as well as from MSDs. Cleaner residue was evaluated by ESCA, FTIR, conductivity, and surface resistivity. Field testing was carried out at several Hughes sites representing a variety of classes of cleanrooms. Methodology developed to evaluate bench-top cleaners in the course of this study is presented. Although some generalizations were made, this report intentionally makes no recommendations as to which cleaners should be used for a particular application. The results of the testing are presented in tables such that those responsible for cleanrooms and clean areas can select the best cleaner for their application. This report does not address the use of the cleaners on tooling, parts, floors, or walls.

D.U. Allison, C. Gill, and G.J. Pachiano. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 321-324, [in English]. PHOTOCOPY ORDER NUMBER: 199303-57-0359.

An Overview of the Regulations and Procedures for Disposal of Epoxy and Phenolic Hazardous Wastes. This paper focuses on the regulations and procedures used in disposing of epoxy and phenolic wastes in the form of prepregs, coatings, and solvent rinsate. California Title 22 and Code of Federal Regulations (40 CFR) are the state and federal regulations that govern the identification and handling of these wastes. Identification is the critical first step in properly disposing of waste. Incineration, supplementary fuels for incineration at a cement kiln, solvent recovery, and landfill disposal are the four most common commercially available methods of disposal. Each of these processes is discussed, and the regulations that apply are detailed. T.M. Ferrier. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 204-215, [in English]. PHOTOCOPY ORDER NUMBER: 199303-57-0356.

New Technology Alkaline Cleaners Replace Chlorinated Solvent Degreasers in the Metalworking Industry. Chlorinated solvents such as trichloroethylene, methylene chloride, perchloroethylene or 1,1,1-trichloroethane have been used for many years by the metalworking industry to clean parts. However, in recent years, health- and disposal-related problems have become increasingly evident. Under the Occupational Safety and Health Administration (OSHA), worker vapor exposure limitations exist for virtually all of the solvents used in solvent-based cleaners. In addition, solvent-based cleaners are virtually all hazardous wastes as defined by the US Environmental Protection Agency (EPA). Because of this, there is an industry-wide effort to reduce or eliminate the use of solvents as cleaners. Today's new technology water-base cleaners can be used instead of chlorinated solvents in many cleaning applications. Volatile organic compounds (VOCs) are reduced, employee exposure is less restricted under most conditions, and the amount of hazardous waste generated can be significantly reduced or eliminated depending on the soils involved.

J.A. Quitmeyer. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering,

1991, 125-134, [in English]. PHOTOCOPY ORDER NUMBER: 199303-57-0355.

Evaluation of Low VOC Coatings for Aerospace Applications. To reduce total VOC emissions in the aerospace industry, the VOC content of many specialty coatings must be eventually lowered below existing limits. The objective of this project (jointly funded by Hughes Aircraft and South Coast Air Quality Management District) was to identify coatings with VOC content significantly below levels allowed under current SCAQMD regulations. These materials were then evaluated for conformance to aerospace performance requirements. Four coating categories were targeted for testing: (1) spacecraft coatings (general and 650 °C resistant), (2) optical antireflection coatings, (3) military topcoats, and (4) conformal coatings. Coatings with significantly lower VOC content than currently allowed were tested. Of these four categories, conformal coatings tested come closest to meeting all military requirements necessary for implementation. Based on physical, processing, and handling properties, several of these materials can be implemented on some product lines without further testing. Few viable candidates in the other specialty categories were found in the VOC range targeted. Discussions with other aerospace users as well as resin and coating manufacturers indicate that water-borne and high solids technology is just beginning to be capable of producing coatings with sufficient properties needed to replace existing high VOC specialty coating applications. Continued evaluation of recently developed coating technologies should produce promising high-performance low VOC candidates in the near future.

J.L. Lum. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 93-103, [in English]. PHOTOCOPY ORDER NUMBER: 199303-57-0351.

Waterborne Adhesive Bond Primers. South Coast Air Quality Management District (SCAQMD) Rule 1124 mandates that all currently used organic solvent-based adhesive bond primers must meet a maximum volatile organic content (VOC) of 250% by 1 January 1993. For several years, Rohr Industries has been extensively testing and evaluating low VOC (water-borne) adhesive bond primers for use on jet turbine engine nacelle assemblies. A full qualification test program has recently been completed on a 177 °C curing water-borne primer for use on aluminum alloy substrates in service environments ranging from -55 to 177 °C. Application of water-borne adhesive primers throughout the test program has been accomplished using high-volume low-pressure (HVL) spray equipment that exceeds the 65% transfer efficiency requirements of SCAQMD Rule 1124. All work to date has shown that water-borne adhesive bond primers can provide equivalent performance to currently used organic solvent-based materials.

B. Millard. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 491-504, [in English]. PHOTOCOPY ORDER NUMBER: 199303-55-0550.

Non-Chromated Anodize Process for Corrosion Resistance and Adhesive Bonding. Rohr Industries has eliminated chromic acid anodizing from its Riverside, California, facility by replacing it with a new, nonchromated process known as sulfuric/boric acid anodizing (SBAA). Joint studies with the Boeing Company have shown SBAA aluminum to have corrosion resistance and adhesion properties equivalent, and in some cases, superior to that produced by chromic acid anodizing. This Boeing Company patented process is currently used by Rohr for the production of corrosion-resistant adhesively bonded aluminum skins. The facility's 2200-gallon SBAA tank has been in continued production use since July 1990 with good results.

J. Mnich. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 371-383, [in English]. PHOTOCOPY ORDER NUMBER: 199303-55-0548.

Low VOC Primer for Structural Bonding. The majority of structural bonding of aluminum alloys on commercial airplanes is with solvent-based corrosion-inhibiting primers cured at 121 °C. The current primers have a large database and years of service experience. The challenge for the early 1990s is to develop new primers that can be used with the same confidence and meet the South Coast Air Quality Management District Rule 1124 of 250 g/L volatile organic compounds (VOC) by 1 January 1993. Boeing is conducting qualification tests on 3M EC3982, which is a one-part, water-base chromated primer. The results of physical and mechanical testing to date to applicable Boeing specifications is encouraging. Testing will continue throughout 1991. The development of improved application techniques

in a production environment will be of prime importance to users as the implementation time for low VOC primer approaches.

W. DuMars. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 119-124, [in English]. PHOTOCOPY ORDER NUMBER: 199303-55-0547.

Application of the Taguchi Design of Experiments Method in a Rule 1168 Solvent Replacement Study. A test program was developed to determine which environmentally compliant surface cleaning solvents can be effectively used for adhesive bonding related processes encountered in ground based aerospace programs in accordance with South Coast Air Quality Management District (SCAQMD) Rule 1168. Five 200 g/L solvents were tested with each of three commonly encountered types of aluminum alloy substrates, adhesives, and contaminants. The data obtained from a full factorial array qualification program were evaluated through the use of Taguchi Design of Experiment (DOE) principles. Through use of a Taguchi L9 array, it was possible to identify and quantify the sources of variation in the strength of the bonding process. It was also possible to determine which combination of adhesive, substrate, contaminant, and solvent yielded the highest shear strength. In the interest of reducing the cost incurred in conducting these tests for the future, the data were analyzed using Taguchi DOE methods and were compared to the conclusions obtained from a traditional qualification program. Four different solvents/blends were found to perform superior to the currently used MEK and acetone. The solvents are 1,1,1-trichloroethane, Genesolv 2010 (an HCFC), 1,1,1-trichloroethane/propylene glycol methyl ether (Dowanol PM), and Genesolv 2010/Dowanol PM.

S.R. Felstein, D.S. Prior, and C. Ford-Livene. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 64-78, [in English]. PHOTOCOPY ORDER NUMBER: 199303-55-0541.

Developing Environmentally Friendly Adhesive Bonding Primers. Aluminum alloy adhesive bonding primers that meet or exceed the 250 g/L limit mandated by South Coast Air Quality Management District, SCAQMD, Rule 1124 and the problems of toxicity and mutagenic activity are discussed. Relative performance to accepted aerospace specifications shows that these primers meet or exceed the demanding requirements of this industry.

A.F. Teschendorf. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 54-63, [in English]. PHOTOCOPY ORDER NUMBER: 199303-55-0540.

Test Methods to Evaluate Water-Based Chemical Mill Maskant. Future Puget Sound Air Control Pollution Agency (PSACPA) regulations are expected to require either water-based chemical mill maskants, or the use of capture systems to control solvent emissions. PSACPA bases the regulations on the best available technology and will likely increase the regulatory restrictions as lower VOC maskants or better solvent recovery systems become available. This paper discusses methods used to optimize maskant dry and cure cycles and a statistically designed experiment to be used to screen new water-based maskants as they become available.

T. Foulds. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 104-118, [in English]. PHOTOCOPY ORDER NUMBER: 199303-53-0219.

Waste Disposal of Candidate Structural Materials in Fusion Reactors Utilizing Different Fuel Cycles. The management and disposal of the radioactive waste generated in any nuclear system are major safety and environmental concerns for the deployment of such a power source. The waste disposal rating is compared for four structural materials when used in deuterium-tritium, D—D, and D—³He fusion reactors. The materials considered are HT-9, primary candidate alloy (PCA), Tenelon, and a modified HT-9. Generic models for the reactors are assumed such that each produces a fusion power of 10 MW/m of the axial length and has a sufficient shield/blanket to produce identical magnet damage rates. The latter is achieved by varying the material compositions and thicknesses. The results show that using the advanced fuel cycle D—³He, with its low neutron yield, alleviates the activation problems and also allows considerable volume reduction of the radioactive waste. This cycle also permits the use of conventional alloys and at the same time satisfies the regulations criteria for

shallow land burial of low-level waste. In addition, and because of the low damage rate in the D—³He reactors, the useful lifetimes of the materials are greatly increased.

H.M. Attaya, M.E. Sawan, and G.L. Kulcinski. Cited: Conference: Environment in the 1990s—A Global Concern, Society for the Advancement of Material and Process Engineering, 1991, 104-118, [in English].

New Pennsylvania Waste Rules Get Two Thumbs Down. Two Pennsylvania metals-recycling companies are displeased with the state's new hazardous waste recycling regulations and believe the rules will drive up the cost of recycling industrial waste. Inmetco, an Inco subsidiary based in Ellwood City, Pennsylvania, points to the fees for environmental consultants and legal advice as major factors in escalating costs. Horsehead Resource Development, which reclaims zinc and other metals from EAF dust, has scrapped plans to rebuild one of the oldest kilns at its Palmerton, Pennsylvania, facility and shifted that processing capacity to its plant in Calumet City, Illinois. The so-called PK-4 regulations, scheduled to take effect 16 Feb 1993, tighten requirements for hazardous waste recycling and reclamation and sharply increase industry fees for hazardous waste permits. The permit application fee for a commercial hazardous waste landfill, will increase from \$3500 to \$125,000.

M. Marley. Cited: *American Metal Market*, 101, (19), 29 Jan. 1993, 9, [in English]. PHOTOCOPY ORDER NUMBER: 199303-S4-0023.

First Joint Environmental Consultancy for China. China's first joint venture environmental consulting firm, Environomics, formed with \$100,000 from Chinese and US investors, will begin doing business in March. The chemical industry is the foremost source of emissions of toxic substances such as mercury, phenol, and chromium. It also emits one third of all industrial wastewater in the country, according to a May 1992 Ministry of the Chemical Industry report. Demand for ozone-depleting chlorofluorocarbons, without any change in technology, is set to triple by the year 2000. Solid waste treatment, isolation, and incineration ventures involving US and Australian firms are under negotiation. The US multinational consulting firm Ecology and Environment (E&E) is also considering a joint venture. Part of the mandate of the firm is to train an expert Chinese consulting sector that will be able to spot opportunities to cut waste and improve efficiency. In 1993, the World Bank will start a 3-year program involving \$600 million and focusing on waste treatment.

S. Hendry. Cited: *Chemical Week*, 152, (6), 17 Feb. 1993, 26, [in English]. PHOTOCOPY ORDER NUMBER: 199303-P4-0016.

EPA to List Safe CFC Alternatives. Last fall, the US EPA created a preliminary policy aimed at governing the use of CFC alternatives. Labeled the "Significant New Alternatives Policy" (SNAP), the final version is set to go into effect this fall. Under the ruling, numerous HCFCs, HFCs, and water-base blowing agents will be deemed either acceptable or unacceptable based on their ozone-depletion and global warming potentials, flammability, and chemical toxicity. Separate listings will be issued for blowing agents used in rigid and flexible polyurethane foams, PUR integral-skin foams, polystyrene extruded insulation board, and sheet, phenolic foam insulation board and polyolefin foams.

R. Monks. Cited: *Plastics Technology*, 39, (2), Feb. 1993, 95, [in English]. PHOTOCOPY ORDER NUMBER: 199303-P4-0014.

House Bill Would Ban Incinerator Building. A US House of Representatives bill seeks to ban the construction of solid waste incinerators until the year 2000, at which time towns sending waste to incinerators would be required to divert 50% of plastics waste for recycling. The bill would amend the Solid Waste Disposal Act to require high percentages of six other commodities be diverted for recycling. Incinerator operators would have to prove that materials to be burned could not be recycled practically, reused, or reduced at the source and that incinerators will not affect human health or the environment. The bill has been referred to the House Energy and Commerce Committee.

Cited: *Plastics News (Detroit)*, 4, (50), 15 Feb. 1993, 4, [in English]. PHOTOCOPY ORDER NUMBER: 199303-P1-0054.

Auto Makers Commit to NiCd Batteries in New Electric Vehicles. Peugeot and Chrysler have both signed contracts that commit them to use NiCd batteries in their new electric vehicles (EVs), and other major companies such as Nissan, Toyota, Honda, and Ford either have plans to follow suit or are continuing with testing that will enable them to make such decisions. Cadmium dealers and producers seem fairly convinced that electric vehicles

will use NiCd batteries over the other options available. What they cannot predict, however, is whether electric vehicles will make enough of a splash to create the boost in demand that the cadmium market so desperately needs. One promising factor is that at least 11 US states, following California's lead, have passed or are in the process of passing emissions standards that demand the use of electric vehicles by the end of this decade.

Cited: *Metals Week*, 64, (3), 18 Jan. 1993, 9, [in English]. PHOTOCOPY ORDER NUMBER: 199303-G7-0106.

Occupational Exposures to Cadmium. Effective 14 Dec 1992, facilities which have employees exposed to cadmium and cadmium compounds must comply with several requirements of the new cadmium standard from the Occupational Safety and Health Administration (OSHA). Employees exposed to cadmium face a significant risk to their health from lung cancer and serious kidney damage at the current permissible exposure limits. The new 8-h time-weighted permissible exposure level (PEL) for employees exposed to cadmium in their work place has been lowered to 5 mg/m³ air. U.M. Harder. Cited: *Finishers' Management*, 38, (1), Jan. 1993, 18-20, [in English]. PHOTOCOPY ORDER NUMBER: 199303-G4-0019.

EPA Initiates Efforts on Metals Recovery, Solid Waste. The EPA has initiated several efforts aimed at developing a regulatory regime that encourages recycling/recovery of industrial materials, including nickel-containing wastes. In response to a legislative mandate, EPA is undertaking a study of the metals-recovery industry. The study will examine the effect of existing regulations on efforts to recover metals from the nation's wastes, as well as how the materials should be regulated to protect human health and the environment and to effectuate the resource conservation and recovery goals of the Resource Conservation and Recovery Act. The study is due to be completed in April 1993. In addition, EPA staff are gathering information to form the groundwork for recommendations to establish an appropriate definition of solid waste and possibly to develop a separate regime for regulating industrial recycling of hazardous materials, including nickel-bearing materials. Agency staff will be collecting information from interested parties through early 1993, with an emphasis on the cost impact of overregulation. Then, presuming the Clinton Administration supports these efforts, EPA will convene a meeting this spring of interested parties and attempt to draft recommendations for implementing regulations.

Cited: *Communique*, (10), Feb. 1993, 7, [in English]. PHOTOCOPY ORDER NUMBER: 199303-G4-0018.

Environmental Protection in the Base Metals Sector—Emissions, Relations, and Ambitions. Environmental protection in the base metals sector has progressed appreciably worldwide over the last three decades. Sweden's contribution to ecology in metallurgy can be seen at the Boliden Pb-Zn works in Laisvall and a smelting works in Ronnskar.

P.G. Broman. Cited: *Bergsmannen*, (6), 1992, 7-10, [in English]. PHOTOCOPY ORDER NUMBER: 199303-G4-0015.

The 1990s: the Environmental Decade. Copper, lead, and zinc producers in what was the nonSocialist world are embarked on mine and plant upgrading programs to comply with environmental legislation which will cost more than \$6 billion. This is one of the conclusions of Metals & Minerals Research Services' recent multiclient report. Some metal producers will simply not be able to financially meet the latest actual or proposed environmental legislation, whereas others will be technically unable to do so. Either way, the result will be profound market instability as the supply sides of the copper, lead, and zinc industries feel the impact of mine and plant closures. S. Hobson. Cited: *Engineering and Mining Journal*, 194, (1), Jan. 1993, 30-31, [in English]. PHOTOCOPY ORDER NUMBER: 199303-G4-0014.

MDA Level Set at Ten Parts per Billion. The US Occupational Safety and Health Administration has established a permissible average exposure limit (PEL) for 4,4-methylene dianiline (MDA), widely used as a curing agent for thermosetting epoxy resins. The PEL sets a limit of an average of ten MDA parts/billion (ppb) of air for an 8-h working day. Short-term exposure limits of 100 ppb for periods of up to 15 min are permissible if the average exposure over the working day is 5 ppb. The new regulations mean that, if airborne exposure is less than 5 ppb without skin contact, then companies need not introduce expensive employee training or hygiene facilities, or provide medical surveillance. Prior to the new ruling, which has in general been well received by the industry, no guidelines for exposure were set in the US despite the findings of laboratory tests on rats that raised the possibility that MDA is a carcinogen.

Cited: *Advanced Composites Bulletin*, Dec. 1992, 7, [in English]. PHOTOCOPY ORDER NUMBER: 199302-P4-0012.

Styrene Level Challenged. The permissible exposure limits set by the US Occupational Safety and Health Administration (OSHA) in 1989 for styrene at 50 parts/million (ppm) (averaged over the 8-h day) have been thrown out by a Federal Court (previous limits were 100 ppm). According to the Composites Institute of the US Society of the Plastics Industry (SPI), OSHA is likely to appeal this ruling and in the interim the 50 ppm rule will continue to apply. If OSHA wins its case, the implication will be that from December 1993 composite molders will not be able to use respirators to achieve the working limits. The exception to this rule will be constructors of large boats. A new rule proposed recently by OSHA for styrene in the maritime, agricultural, and construction industries has an added restriction because it identifies styrene as a possible carcinogen. The SPI is prepared to testify before OSHA to remove this classification, which is contrary to the evidence amassed by the industry in recent years.

Cited: *Advanced Composites Bulletin*, Dec. 1992, 7, [in English]. PHOTOCOPY ORDER NUMBER: 199302-P4-0011.

[US] State Legislatures May Host Bevy of Environmental Bills. Solid waste legislation that could affect plastics is expected to be introduced in at least 30 US states in 1993. The spotlight will be on bills aimed at increasing the demand for recycled materials. In 1992, lawmakers considered 500 bills affecting plastics and approved 90. US industry representatives said they consider the passed laws to be realistic. States expected to be most active on solid waste legislation in 1993 include California, Florida, Maryland, Minnesota, New York, North Carolina, Oregon, Vermont, Washington, and Wisconsin.

J. Gardner. Cited: *Plastics News (Detroit)*, 4, (46), 18 Jan. 1993, 11, [in English]. PHOTOCOPY ORDER NUMBER: 199302-P4-0010.

[US] EPA Banning CFC-Containing Foams. The US Environmental Protection Agency on 4 January 1993 announced the final rule banning the sale of plastic foams that contain chlorofluorocarbons as a foaming agent. The rule, which will be effective 1 year after it is published in the Federal Register, implements a section of the Clean Air Act of 1990 that bans nonessential products that contain the ozone-depleting chemicals CFCs, halons, carbon tetrachloride, and methyl chloroform. Rigid and flexible plastic foams made for packaging, insulation, and other applications sometimes use CFCs in manufacturing. Because EPA believes viable substitutes for CFCs are available in those applications, however, plastic foams qualify as a nonessential product.

Cited: *Plastics News (Detroit)*, 4, (45), 11 Jan. 1993, 3, [in English]. PHOTOCOPY ORDER NUMBER: 199302-P4-0009.

EPA Publishes MACT Schedule. On 24 September 1992, the US Environmental Protection Agency published a list of industry categories and the dates by which the agency is to establish Maximum Achievable Control Technology (MACT) standards for each category. MACT standards for the Reinforced Plastics Composites Production category are due by 15 November 1997. Assuming that EPA keeps to this deadline, this means that composites manufacturing facilities will have until 15 November 2000 to comply. The MACT standard for composites will be developed by the EPA's Office of Air Quality Planning and Standards.

J. Schweitzer. Cited: *CI on Composites*, Dec. 1992-Jan. 1993, 8, [in English]. PHOTOCOPY ORDER NUMBER: 199302-D4-0004.

EPA Publishes Permit Guidelines for States. Under the Clean Air Amendments (CAA), US states must adopt permit programs for air emission by November 1993. EPA recently published the guidelines that are to be used by the states in developing their permit programs. A facility's permit is to cover all air emissions. States are encouraged by EPA to adopt permit shield provisions. Such a provision would mean that if a facility is in compliance with its permit, then it may be assumed that the facility is also in compliance with all applicable air emission regulations and standards.

J. Schweitzer. Cited: *CI on Composites*, Dec. 1992-Jan. 1993, 8-9, [in English]. PHOTOCOPY ORDER NUMBER: 199302-D4-0003.

EPA to Regulate Styrene in Solid Waste. The US Environmental Protection Agency recently withdrew its proposed modifications to the Resource Conservation and Recovery Act (RCRA) Hazardous Waste Identification Rule (HWIR), citing criticism from environmental groups and states. The proposed changes to the HWIR would have meant that certain

styrene-containing waste would have been classified as hazardous. The agency reported that the modifications will be reissued within 12 to 24 months, and it is likely that styrene will still be regulated under any new proposal. Under the recently-withdrawn HWIR proposal, materials containing more than 10 mg/L of styrene in the TCLP solution were to be classified as toxic under RCRA and would be handled and disposed of as hazardous waste. Preliminary testing has indicated that although fully cured composites will not be classified as toxic, partially cured materials may leach more than the minimum amount of styrene.

J. Schweitzer. Cited: *CI on Composites*, Dec. 1992-Jan. 1993, 9, [in English]. PHOTOCOPY ORDER NUMBER: 199302-D4-0002.

Environmental Policies Put the US Nonferrous Metal Industry under Pressure—On Current Developments in Legislation. A debate about environmental problems is presently going on in the US, the outcome of which could have far-reaching consequences in the nonferrous metal industry. After the recently passed modified version of the Clean Air Act, the debate in Congress focuses on the possible enactment of a modification of the Resource Conservation and Recovery Act (RCRA). The treatment and disposal of solid wastes is its principal objective. The continuing debate over the RCRA and its consequences also delays ratification of the Basel Convention by the US Congress. The impact of the latter on the American transport of potentially hazardous materials that are destined for recycling is one of the issues confronting the US government. The major part of the article is devoted to the most important problems faced by the individual nonferrous

metal industries, i.e. those producing or dealing in aluminum, copper, lead, nickel, zinc, mercury, and precious metals.

A.E. Abrahams. Cited: Original Title: [Die NE-Metallindustrie in den USA Umweltpolitisch Unter Druck—Zur Aktuellen Entwicklung in der Gesetzgebung], *Metall*, 46, (9), Sept. 1992, 963-965, [in German]. PHOTOCOPY ORDER NUMBER: 199302-G4-0008.

Theisen Sludges in the Mansfeld District—Recycling or Disposal? A Proposed Concept for Recycling. In the 1980s, the Mansfeld mining combine, still under GDR control, requested from the metallurgical branch of Lurgi AG in Frankfurt the development of a concept of use of lead, zinc, and germanium contents of the Theisen sludges. Initially, the costs were judged to be too high for the expected yield. Owing to the environmental protection laws of the FRG, Lurgi AG and Mansfeld AG have expanded the original concept of exploiting the Theisen Sludge. Emphasis has been placed on waste gas purification and in particular on dioxide retention. In the conceptualized recycling process, the principal areas highlighted are mining, transfer, ore dressing and concentration, roasting, postheating and purification of the roast gas, and sulfuric acid recovery. The capacity of the installation, waste disposal costs, and time span for planning, installation, and start of operation are also covered.

R. Lorenz, M. Tacke, K. Hartman, and E. Weilandt. Cited: Original Title: [Theisenschlamme im Mansfelder Revier, Verwertung Oder Deponierung? Ein Konzeptvorschlag zur Verwertung], *Metall*, 46, (9), Sept. 1992, 955-957, [in German]. PHOTOCOPY ORDER NUMBER: 199302-G1-0043.

Photocopies of complete articles are available from the MI Document Service at ASM; please call (216) 338-5151, Ext. 450, for order and price information.

FURTHERMORE...

Environmental Quality, a comprehensive, understandable, and authoritative desk reference, now available from the **U.S. Government Printing Office**, Washington, DC, presents information on *environmental conditions and trends, as well as summaries of national and international policies* that are in place or under development to address current environmental challenges. Twenty-two sections summarize national and international environmental policies, as well as the key conditions and trends in specific issue areas. Federal environmental programs in air and water quality assistance, distribution of public lands, and highlights of recent environmental actions are included. Circle (80)

An inventor from California has designed a unique machine that effectively helps to avert environmental hazards. The Oil Filter Crusher *flattens used motor vehicle filters and extracts the trapped oil* from inside the container walls and from their fiber-paper strainers. Not only does this increase the amount of oil that can be used for recycling, but it reduces the quantity of landfill bulk and lessens the chances of oil leaching into the landfill ground. The crusher can squash

several filters simultaneously for cost- and time-effective operation. It is constructed from durable, sturdy metal and has a number of built-in safety features. The design has been submitted to the **Invention Submission Corporation**, Anaheim, California, and is currently available for licensing or sale to manufacturers or marketers.

Circle (81)

A new aid for designers of plastic medical products and packaging is now available to help address life cycle environmental concerns. Environmental Design Guide, published by the **Healthcare Div. of The Society of the Plastics Industry, Inc. (SPI)**, is a 30-page booklet that uses flow charts and relevant step-by-step questions to map out a decision tree for designers to follow in *making new plastic medical products and packaging more environmentally friendly*. It illustrates how to incorporate environmental goals, particularly recycling issues, into the design of plastic products and packaging. Circle (82)

Scientists and engineers working in the water management and environmental fields will soon have access to a **powerful**

knowledge-based system for modeling soil and groundwater contamination problems. The new system has been developed by the **International Groundwater Modeling Center**, part of the TNO Institute of Applied Geoscience, Delft, The Netherlands, in cooperation with the Universitat Politècnica de Catalunya, Barcelona, Spain, the Escuela Técnica Superior de Ingenieros de Minas, Madrid, Spain, the Danish Hydraulic Institute, and TNO Institute of Applied Physics. The final version of the program provides users with detailed information on modeling concepts and available model codes for studying a wide range of contamination issues. Circle (83)

One company's waste can be another company's resource.... **Pacific Materials Exchange (PME)**, Spokane, Washington, has received an extension of a grant from the U.S. Environmental Protection Agency to continue its pioneering efforts to implement *a national computerized industrial waste exchange network* to encourage pollution prevention. PME has developed the National Materials Exchange Network, which electronically links, for the first time, virtually every

industrial waste exchange in the United States. Several exchanges in Canada have recently joined the network, as well. The network allows subscribers to use a computer and modem to call a toll-free number in the United States and receive the latest information on materials located across town or across the country. U.S. subscribers call 800/858-6625; Canadian subscribers call 509/325-1724. Once connected, the network guides users through a series of easy on-screen direction. The National Materials Exchange Network lists materials available and materials needed, including waste by-products, off-spec, overstock, obsolete, and damaged materials, used and virgin, solid, and hazardous. There are currently 4000 materials listed by the Exchange Network. It is estimated that industry saves approximately \$27 million and the energy equivalent of 100,000 barrels of oil annually by using waste exchange.

Munters Zeol. Amesbury, Massachusetts, is offering a four-page technical paper on hydrophobic zeolites, a synthetic adsorbent used in their rotor concentrator systems to *remove VOCs from various industrial air-streams*. Containing six diagrams, tables, and graphs, it describes the basic structural element of the zeolite, its material properties, use with chemical compounds, adsorptive properties, and compatibility with reactive solvents. The paper describes how the uniform pore structure of zeolite selectively adsorbs organic molecules. It also addresses why zeolites are nonflammable and chemically inert, making them effective for use in low-VOC concentration, high-volume applications. Circle (84)

The American Welding Society is mounting a welding history exhibit during the 1994 International Welding Exposition in Philadelphia, Pennsylvania. To create an exhibit worthy of such a momentous industry-wide event, a unique collection of welding-related materials is being sought. Items with display potential are patents, designs, magazine/newspaper articles, equipment, welded products, components, apparel, or anything else that would track the industry's passage through time. Corporations or individuals who own or can gain access to such materials are urged to contact AWS and confirm their availability. Please do not send any materials at this time. Write: 75th Memories, AWS, Marketing Communications Dept., P.O. Box 351040, Miami, FL 33135.

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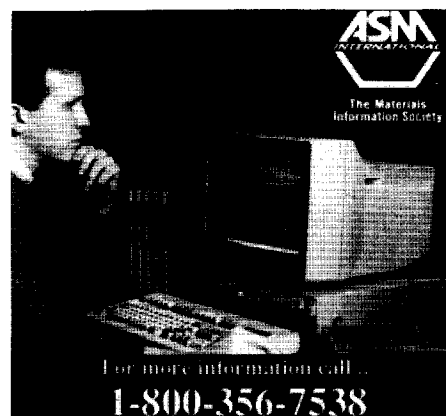
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