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Project Summary

Proceedings: Symposium on Environmental Aspects of Fuel Conversion Technology—VI, A Symposium on Coal-Based Synfuels—October 1981

F. A. Ayer and N. S. Jones

The document summarizes or contains an abstract of each presentation made at the EPA-sponsored symposium, October 26-30, 1981, in Denver, CO. The symposium provided a forum for the exchange of ideas and for discussion of environmentally related information on coal gasification and liquefaction. Process developers and users, research scientists, and government officials reported on results achieved from research projects, synfuels process development, interagency programs, control technology evaluation, and regulatory actions. The program included sessions on environmental source test and evaluation results for gasification, indirect liquefaction, and direct liquefaction processes, and water-, air-, solid waste-, multimedia-, and product- related environmental considerations. Approximately 215 participants attended the 5-day symposium.

This Project Summary was developed by EPA's Industrial Environmental Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

This report summarizes speakers' presentations contained in the proceedings of the EPA-sponsored Symposium on the Environmental Aspects of Fuel Conversion Technology - VI, a Symposium on Coal-Based Synfuels, Denver, CO, October 26-30, 1981. The symposium provided a forum for the exchange of ideas and for discussion of environmentally related information on coal gasification and liquefaction. Process developers and users, research scientists, and government officials reported on results from research projects, synfuels process development, interagency programs, control technology evaluation, and regulatory actions. The program included sessions on environmental source test and evaluation results for gasification, indirect liquefaction, and direct liquefaction processes, and water-, air-, solid waste-, multimedia- and product-related environmental considerations. Approximately 215 participants attended the symposium.

Abstracts of speakers' remarks follow:

Session I, Part A. Environmental Source Test and Evaluation Results, Gasification and Indirect Liquefaction

Characterization of Process Liquids and Organic

Condensates from the Lurgi Coal Gasification Plant at Kosovo, Yugoslavia

K.J. Bombaugh, K.W. Lee, and R.G. Oldham, Radian Corp. Austin, TX 78766

S. Kapor, Institut za Primenu Nuklearne Energy Beograd-Zemun, Yugoslavia

Process liquids and gaseous stream condensates from the Lurgi Coal gasification plant at Kosovo were characterized to define their organic composition. Samples of entrained liquids and condensates were collected during Phase II of the Kosovo source test that was described at the preceding synfuels symposium. These samples were characterized by liquid chromatographic fractionation using EPA's protocol for a Level I source assessment. In addition, GC/MS analyses were performed on key samples to quantify their levels of potentially hazardous PNAs, and GC with selective detection was used to characterize sulfur- and nitrogen-bearing species.

This presentation discussed the analytical results and impact that these condensates had on the plant's discharge stream severity. It also compared the composition of liquids from the Lurgi process with that of liquids from other processes.

Application of Kosovo (Lurgi) Gasification Plant Test Results to Pollution Control Process Design

G.C. Page, W.E. Corbett, and R.A. Magee, Radian Corp. Austin, TX 78766

This paper describes a test program performed by Radian Corporation to obtain process data to define the pollution control technology requirements for Lurgi-based coal gasification plants. This program was sponsored by EPA's Industrial Environmental Research Laboratory (Research Triangle Park) and conducted at a Lurgi-based gasification plant in the Kosovo region of Yugoslavia. It should be emphasized that the Kosovo plant does not reflect state-of-the-art Lurgi technology especially in pollution control practices. However, the uncontrolled process discharge streams from the Kosovo plant are representative of those from Lurgi-based gasification plants.

From an assessment of the Kosovo data, the following discharge streams were selected to be key based on flow rate and/or concentration of pollutants: (1) high- and low-pressure coal lock vent gases and ash from the gas production section, (2) liquid depressurization gases and surge tank vent gases from tar/oil separation section, (3) H_2S- and CO_2-rich vent gases from the Rectisol acid gas removal section, and (4) extracted wastewater from the Phenosolvan unit.

The conclusions of an engineering evaluation of the components in those key discharge streams and the effects those components may have on pollution control processes were: (1) pollution control processes are commercially available for treating these streams; (2) the effects of minor and trace components on the performance of those control processes have not been demonstrated, and there may be problems in the direct transfer of technology from other industries (e.g., coke ovens); (3) the design and selection of pollution control processes during transient and normal operation should occur in parallel with the base plant design; and (4) the variability of the components in the discharge streams must be determined and included in pollution control process design.

Environmental Aspects of the GKT Coal Gasification Process

R.E. Wetzel, GKT 43 Essen, Federal Republic of Germany

K.W. Crawford, TRW Redondo Beach, CA 90278

W.C. Yee, TVA Chattanooga, TN 37401

Thermal conversion of coal is always accompanied by the production of: pyrolysis products; solid wastes like ash, slag, or fly dust; different sulfur compounds; and a number of undesired trace compounds in the gas. The quality and quantity of these components depend on the applied process principle, the composition of the reactants, and the main process parameters (e.g., temperature and pressure). The GKT high-temperature, entrained coal gasification process, well-established commercially for 30 years, offers coa conversion with minimum environmen tal impact.

To evaluate the operating condition and environmental impact when gasify ing American coal, TVA and GK conducted a large-scale test with abou 5,000 short tons of Illinois No. 6 coal in a commercial coal-to-ammonia plant ir Greece. TRW, funded by TVA, cooperate in the extensive test program regardin the environmental aspects. The favor able results of the test runs, carried ou in March/April 1981, and the extraordi narily low environmental impact demon strated, have led to TVA's decision t build its Murphy Hill plant based o GKT's technology.

Source Test of the Texaco Gasification Process Located at Oberhausen-Holten, West Germany

R.G. Wetherold and R.M. Mann, Radian Corp. Austin, TX 78766

J. Morgan and W.C. Yee, TVA Chattanooga, TN 37401

P. Ruprecht, Ruhrchemie AG 4200 Oberhausen-Holten, Federal Republic of Germany

R. Dürfield, Ruhrkohle 01 und Gas GmbH 4250 Bottrop, Federal Republic of Germany

A comprehensive environmenta characterization of water and solid from the Ruhrkohle/Ruhrchemie co gasification pilot plant in Oberhauser Holten, West Germany, has bee conducted. Coal is gasified at the plar with a high-pressure, entrained-be coal gasification process. The pilot plar tests were conducted in Novembe 1980 during gasification of Illinois No. coal. A test plan was prepared includin stream selection, sample collection an chemical analyses. Multiple samples process waters and solids were collecte during two 12-hour environmenta balance periods. Normal pilot plar operation was maintained during th first period; the second incorporate water recycle to minimize makeu water requirements.

Samples of liquid and solid proce streams have been subjected to compr hensive analyses. These efforts, und contract with TVA, have been performe

to provide support information on both the process operation and environmental impact associated with a 10,000-ton per day coal gasification plant proposed by TVA for a northern Alabama site. Topics addressed in the presentation included pilot plant configuration and operation, treatment of the process water, and RCRA testing of solids from the gasification and water treatment processes.

Source Test and Evaluation of a Riley Gas Producer Firing North Dakota Lignite

F.L. Jones, American Natural Service Co.
Detroit, MI 48226

W.P. Earley, Riley Stoker Corp.
Worcester, MA 01613

M.R. Fuchs, Radian Corp.
Austin, TX 78766

V.A. Kolesh, Riley Stoker Corp.
Worcester, MA 01613

A 10-ft 6-in. diameter Riley Morgan gasifier was operated for 14 days to convert North Dakota lignite to low Btu gas. During that period, the gasifier was operated at a range of load conditions, and the product gas was transported to a commercial-scale kiln burner in a large combustion test chamber. Process stream conditions and compositions were recorded throughout the test and were submitted to an SAM/IA analysis. Gaseous effluent streams were found to be well controlled due to the unique Riley coal-feed and poke-hole systems. Solid wastes from the process (gasifier ash and cyclone dust) were found to be nontoxic, noncarcinogenic, and nonmutagenic. Gasifier wastewater effluent (ash pan water) was similarly found to be nonhazardous. Although combustion stack gases were not monitored, sulfur and particulate loadings in the gasifier product gas indicated that the stack gases would comply with current EPA New Source Performance Standards. If all reduced nitrogen compounds were converted to NO_x, however, these emissions would exceed New Source Performance Standards.

Session I, Part B. Environmental Source Test and Evaluation Results, Direct Liquefaction

Environmental Program and Plans for the EDS Coal Liquefaction Project

R.L. Thomas, Exxon Research and Engineering Co.
Florham Park, NJ 07932

The Exxon Donor Solvent (EDS) coal liquefaction project is a unique government/industry arrangement for developing EDS technology to the point that commercial plants can be designed with an acceptable level of risk. A broad environmental program is being advanced within the project to address plant emission, occupational health, and product-related environmental concerns associated with the direct liquefaction of coal. The current plans, status, and outlook for the EDS environmental program provide an overall strategy for the acquisition of data relating to these concerns early in the technology development cycle.

Sampling and Analysis of Process and Effluent Streams from the Exxon Donor Solvent Coal Liquefaction Pilot Plant

M.D. Notich and J.I. Kim, Hittman Associates, Inc.
Columbia, MD 21045

Under contract to the U.S. EPA, Hittman Associates performed a sampling and analysis of process discharge streams from the Exxon Donor Solvent (EDS) coal liquefaction plant in Baytown, TX. Twenty-four streams were sampled and 2,200 samples were returned to Hittman's laboratory for analysis. The chemical analyses of these samples included water quality parameters, GC/MS, GC/FID, and bioassays. Analyses were also performed to determine the accuracy and precision of the data and to determine the variability of stream components due to process variations. Preliminary results are available and data for the source test and evaluation report are being evaluated.

Health and Environmental Studies of H-Coal Process

K.E. Cowser, J.L. Epler, C.W. Gehrs, M.R. Guerin, and J.A. Klein
Oak Ridge National Laboratory
Oak Ridge, TN 37830

With the implementation of the Energy Security Act of 1980, coal and oil shale are expected to be principal sources for petroleum and natural gas substitutes. H-Coal is one of several processes under intensive study for the direct conversion of coal to the desired synthetic fuels.

This paper describes the health and environmental study program of H-Coal, sponsored by the Department of Energy. Presented are the results of the chemical, biological, and ecological characterization of products and by-products derived from the operation of a process development unit. These initial results provide an informed basis for subsequent monitoring and testing of the nominal 200- to 600-ton/d pilot plant at Catlettsburg, KY.

Chemical Characterization and Bioassay of SRC Process Materials

W.D. Felix, D.D. Mahlum, B.W. Wilson, W.C. Weimer, and R.A. Pelroy
Battelle Pacific Northwest Laboratory
Richland, WA 99352

Bioassay techniques have shown that certain coal liquefaction process streams and products are both mutagenic (Ames assay) and carcinogenic. These materials have been chemically fractionated using a number of techniques (solvent extraction, alumina column separation, HPLC, Sephadex LH-20) in an attempt to identify the constituents responsible for the biological activity. These studies have shown that primary aromatic amines (PAAs) account for more than 90% of the mutagenic response in the Ames test. Long-term skin painting and initiation-promotion assays indicate that the PAAs may also play a role in the carcinogenicity of the coal-derived materials. However, while the PAAs can be designated as the determinant mutagens in coal liquids, they cannot be assigned a determinant role in skin

carcinogenesis. Thus far, carcinogenicity appears to better correlate with increasing molecular weight and boiling point. Our results also suggest that benzo(a)pyrene is not a reliable marker compound for carcinogenic activity.

(Only the abstract is published in the proceedings.)

Session II. Water-Related Environmental Considerations

Coal Conversion Wastewater Treatment/Reuse - An Overview

F.E. Witmer, U.S. Department of Energy
Washington, DC 20545

Environmentally, synfuels can be produced from coal by either low- or high-temperature processes. Low-temperature processes produce high boiling liquids and tars which tend to retain the multiple-ring structure of the original coal "molecule," while high-temperature processes typically produce synthesis gas, methane, and/or light liquids. Dry-ash moving-bed gasification and direct liquefaction processes are representative of low-temperature conversion processes. Entrained gasification is an example of high-temperatures processes. Fluid-bed gasification processes that operate at temperatures just below the ash slagging point may produce limited heavy liquids and fall intermediate within the classification regime.

Depending on the process, process steam which is subsequently condensed and/or gas cleanup quench waters come into direct contact with the raw gaseous product stream. As a consequence, the resultant wastewater associated with the low-temperature processes is highly contaminated with organics. The production of ammonia in the high-temperature processes is generally suppressed and reduced due to "cracking." Condensate waters from high-temperature processes usually contain little or negligible NH_3, while the condensate waters from low-temperature processes contain high levels of NH_3. The condensate waters from both low- and high-temperature processes generally contain volatized and entrained mineral matter, trace elements, and salts, as well as adsorbed H_2S, CO_2, and cyanates.

Treatment of the condensate waters from low-temperature processes poses a special challenge due to the high and variable level and toxic nature of the gross organics. A portion of the total organic carbon is biorefractory, also causing concern. Laboratory treatability tests have demonstrated that, with appropriate dilution and/or pretreatment (e.g., gas stripping, organic extraction, and/or the addition of powdered activated carbon), activated sludge treatment processes do a reasonable job of reducing biological oxygen demands (BOD) and total organic carbon (TOC) levels, and coupled with activated carbon treatment, relatively high quality effluent can be produced. In a "zero discharge" mode, subsequent concentration and reuse of the effluent must be effected to ultimately produce a concentrated brine or dry salt.

The questions that remain center on the capability of this rather elaborate treatment train to accommodate variabilities in the raw feed and on the reliability and costs of such a system; i.e., do viable alternatives exist? Options are outlined with special emphasis on: (1) improvements to biological treatment, and (2) purely physical/chemical systems. The effect of more stringent standards with respect to the control of biorefractory ring-structure compounds, trace elements, ammonia, etc., is discussed relative to the state-of-the-art biotreatment and these environmental control options. Areas of uncertainty and future research are delineated based on a recent synfuel wastewater workshop conducted in June 1981.

Characterization of Coal Conversion Wastewaters Using On-Site GC/MS

C.J. Thielen and R.V. Collins,
Radian Corp.
Austin, TX 78766

This paper discusses a characterization of a wastewater stream from a coal gasification facility using on-site extraction and GC/MS analysis. The objectives of the program were to:

- Characterize the wastewater organic components primarily for selected priority pollutants, Appendix C, and synfuels compounds.
- Investigate the stability of these compounds during refrigerated and ambient storage.
- Evaluate the destruction of organics by wet oxidation.

Extractable material in the wastewa ter consisted primarily of phenols an alkylphenols. These compounds ac counted for about 98% of the tota organic mass identified. Several polynu clear aromatic (PNA) compounds wer also identified. Deterioration in th composition of the sample was observe over a 1-month period. This was mos evident in the concentration of dimethyl phenols which dropped approximatel 75% during 2 weeks of refrigerate storage. Ambient sample storage pro duced a greater decrease in the concen tration of phenol but did not appear t affect the alkylphenols or the base/ neutral compounds as much as phenols It is expected that the observed change in composition would hamper any off site wastewater treatability studies wit water of this type. Treatment of th wastewater by wet oxidation was als evaluated and found to remove greate than 90% of the extractable organics.

Treatment of Wastewater from a Fixed-Bed Atmospheric Coal Gasifier

P.C. Singer and E. Miller,
University of North Carolina
Chapel Hill, NC 27514

Previous studies using a simulate coal conversion wastewater hav demonstrated the feasibility of treatin this type of waste by an activated sludg process. Phenol concentrations wer reduced to levels below 1 mg/l, and th toxicity and mutagenicity of the simu lated wastewater were reduced sub stantially by the biological treatmen This paper gives results of an evaluatio of the biological and subsequent physica chemical treatability of a real coa conversion wastewater, along with comparison of the results with thos obtained using the simulated waste water.

Coal gasification wastewater wa obtained from a Chapman gasifier at th Holston Army Ammunition Plant i Kingsport, TN. The wastewater wa diluted to 25% of full strength, supple mented with phosphate, and subjecte to aerobic biological treatment in 22.5-liter completely mixed activate sludge reactor. The reactor was operate at a solids retention time of 20 days an a hydraulic detention time of 10 days. I addition to characterizing the quality the effluent using various chemical an bioassay procedures, the effluent fro the biological reactor was subjected to

series of physical-chemical treatment steps consisting of chemical coagulation, ammonia stripping, ozonation, and activated carbon adsorption. The chemical quality and bioassay characteristics of these various samples are presented.

Treatment of Fossil Fuel Derived Wastewaters With Powdered Activated Carbon/Activated Sludge Technology

R.B. Ely and C.L. Berndt,
Zimpro, Inc.
Mercer Island, WA 98040

The treatment of high-strength fuel conversion wastewaters by conventional biological treatment processes may be operationally troublesome and only marginally effective from the standpoint of treatment system stability and performance. The addition of powdered activated carbon to the activated sludge process not only greatly improves product water quality but also provides cost savings compared to more conventional waste treatment and carbon regeneration processes.

This paper describes the powdered carbon/activated sludge wastewater treatment process, discusses the advantages of powdered carbon addition including performance obtained on fossil fuel derived wastewaters, and presents cost comparison data for wastewater treatment and spent carbon regeneration.

Land Treatment of Coal Conversion Wastewaters

R.C. Sims (now with Utah State University, Logan, UT 84322) and M.R. Overcash,
North Carolina State University
Raleigh, NC 27650

This research project investigated the treatment potential of soil systems for polynuclear aromatic compounds (PNAs) present in aqueous wastes from coal conversion processes. A protocol for obtaining the soil assimilative capacities for mutagenic and recalcitrant PNA compounds was developed and, for a subset of compounds, data were obtained to describe: (1) rates of transformation, including degradation, detoxication, and possible intoxication; (2) effect of PNA structure on transformation rate; (3) effect of engineering management options, including nutrient addition, analog enrichment, surfactant addition, and pH adjustment on transformation rates; and (4) soil acclimation to PNAs.

A three-step protocol—including: (1) incubation, (2) identification, and (3) determination of mutagenic potential—involves interfacing high-performance liquid chromatography (HPLC) for compound and metabolite identification with the Ames *Salmonella typhimurium*/mammalian microsome mutagenicity assay for determining genotoxic potential of PNA compounds and transformation products in soil. Identification (HPLC) and mutation (Ames assay) were quantified.

Session III. Air-related Environmental Considerations

Removal of Acid Gases and Other Contaminants from Coal Gas Using Refrigerated Methanol

J.K. Ferrell, R.M. Kelly, R.W. Rousseau, and R.M. Felder
North Carolina State University
Raleigh, NC 27650

The steam-oxygen gasification of a New Mexico subbituminous coal was carried out in a pilot-scale fluidized-bed gasifier. Gas cleaning was accomplished by a hot cyclone, a water-quench venturi scrubber, filters, and an acid gas removal system using refrigerated methanol as the solvent. Results of both gasification and gas cleaning are described. Refrigerated methanol proved to be effective in cleaning the gasifier-make gas; however, several reduced sulfur species and hydrocarbons were detected in the absorber, flash tank, and stripper exit gas streams over a wide range of operating conditions. While a variety of simple aromatics accumulated in the recirculating methanol, essentially no polynuclear aromatic (PNA) compounds were detected. Most PNAs were evidently removed in the gas quenching process.

Advanced Techniques for Flue Gas Desulfurization

C.C. Masser, M.A. Maxwell, and T.G. Brna
Industrial Environmental Research Laboratory, U.S. EPA
Research Triangle Park, NC 27711

In 1979 the combustion of sulfur-bearing fuels accounted for more than 80% of the SO_2 emissions in the U.S. These emissions can be controlled to a degree by burning low-sulfur fuels or by pretreating the fuel to lower its sulfur content. Currently the most widely practiced technological control involves scrubbing the combustion flue gases to remove the SO_2. Flue gas desulfurization systems can be categorized as nonregenerable (or "throwaway") and regenerable (or producing a salable product). The advantages and disadvantages of several systems in each category are discussed. Several recent developments in waste disposal and enhanced SO_2 removal are also presented.

Health and Environmental Studies of Coal Gasification Process Streams and Effluents

C.A. Reilly, Jr., A.S. Boparai, S. Bourne, R.D. Flotard, D.A. Haugen, R.E. Jones, F.R. Kirchner, T. Matsushita, M.J. Peak, V.C. Stamoudis, J.R. Stetter, and K.E. Wilzbach,
Argonne National Laboratory
Argonne, Il 60439

The synfuels environmental research program at Argonne National Laboratory is investigating the impact of high-Btu coal gasification on health and the environment. Activities include a toxicologic and chemical characterization of process streams in the gasifier and pretreater sections of the Hygas coal gasification pilot plant, and process streams and workplace air from the Grand Forks Energy Technology Center's slagging fixed-bed gasifier facility. Cellular assays for mutagenicity, cytotoxicity, and functional impairment are performed to determine relative toxicity. Various acute and chronic whole-animal toxicological evaluations, including skin tumorigenesis, are performed for streams found to contain potential toxicants (e.g., oils and tars). The chemical characteristics of vapor-phase and airborne particulate-associated organics, as well as biologically active materials isolated from process streams, are investigated by physical and chemical fractionation of the samples, with biological monitoring and detailed GC and GC/MS analyses of the fractions. Present data indicate that toxicants are

present, but their levels of activity are relatively low. As a result of these studies, it is tentatively concluded that with appropriate control technology and industrial hygiene procedures, no serious health or environmental problems appear to be associated with coal gasification.

Gaseous Fugitive Emissions from Synfuels Production - Sources and Controls

R.L. Honerkamp, Radian Corp.
Austin, TX 78766

Fugitive emissions are generally defined as emissions that are not released through an enclosure such as a duct or vent pipe. Fugitive emissions of volatile organic compounds (VOCs) are caused by process fluid leakage from seals (valves, pumps, etc.), process fluid purges (sampling, equipment cleaning), and secondary emission sources (drains, wastewater systems, towers). Most sources of fugitive VOC emissions in the U.S. are currently found in petroleum production and refining facilities, organic chemical manufacturing plants, and coke by-product plants. Synfuels production facilities will also have VOC fugitive emission sources. The paper describes the potential sources and control options for fugitive VOC emissions in synfuels production facilities.

Fugitive emission regulations have been applied to California petroleum refineries for several years, and U.S. New Source Performance Standards (NSPS) are currently under development for several industries. These regulations are based on the need to reduce fugitive emissions because VOCs are photochemical ozone precursors. Some fugitive emissions also need to be controlled because compounds released in the emissions may be hazardous. U.S. National Emission Standards for Hazardous Air Pollutants (NESHAP) have been developed for controlling fugitive emissions of vinyl chloride and benzene. VOC emissions from synfuels production facilities may require control because they contribute to atmospheric ozone formation and/or because they contain hazardous compounds. The nature of potential hazardous compounds will depend on variables such as the type of process, feedstock characteristics, and operating parameters

Fugitive emission controls can be categorized as work practices or engineering controls. Work practices would include leak detection and leak repair programs and good housekeeping practices. Leak detection and repair programs involve periodic testing to locate significant VOC leaks and subsequent repairs to reduce or eliminate the leakage. Housekeeping practices would include procedures to minimize process fluid spills and to expedite spill cleanup. Engineering controls are generally equipment substitution strategies. For example, closed-loop sampling connections eliminate process fluid purge emissions, and double mechanical pump seals can be operated to minimize emission potential. These types of equipment would be used instead of equipment with a greater potential to leak VOC.

Because the emission sources (pumps, valves, etc.) on synfuels plants will be similar to those in existing U.S. industries, the emission control techniques will also be applicable. The experience that has been gained in applying fugitive VOC emission controls will be valuable in developing VOC control strategies for synfuels plants.

Control Systems for Air Emissions from Coal Gasification

S. Thomson, Fluor Engineers and Constructors, Inc.
Irvine, CA 92730

This paper discusses control systems for air emissions on coal conversion projects. Topics include the control of emissions from acid gas treatment processes and the control of emissions from gasification reactors. Alternate control systems as well as the difficulties involved in establishing the Best Available Control Technology (BACT) are also covered.

Session IV. Solid Waste-Related Environmental Considerations

Health Effects Bioassay Results from Coal Conversion Solid Wastes

M.P. Maskarinec, F.W. Larimer, J.L. Epler, and C.W. Francis
Oak Ridge National Laboratory
Oak Ridge, TN 37830

To assist EPA and DOE in identifying solid wastes that may pose a potential hazard to human health and environment, the Oak Ridge National Laboratory has conducted studies on extracts from solid wastes obtained from various coal liquefaction and gasification processes. Analytical procedures to chemically characterize and separate the organic and inorganic constituents were developed. Various approaches to extraction were compared. Batteries of health effects and environmental assays were applied to the extracts or their fractions to indicate chronic hazards The applicability and compatibility of the coupled chemical and biological procedures are evaluated with particular emphasis on the Ames mutagenicity test.

A Comparison of RCRA Leachates of Solid Wastes from Coal-Fired Utilities and Low- and Medium-Btu Gasification Processes

M.R. Fuchs, D.L. Heinrich, L.J. Holcombe, and K.T. Ajmera,
Radian Corp.
Austin, TX 78766

EPA has promulgated regulation which temporarily exclude utility waste (including fly ash and bottom ash fror coal-fired generating stations) fror Subtitle C of the Resource Conservatio and Recovery Act (RCRA) regulations EPA, using broad interpretation c amendments to the Act, has als excluded coal gasification solid waste from Subtitle C regulations, and thes wastes are listed as nonhazardou pending further data evaluation. Thi paper gives comparative results c RCRA leachates of the solid waste from two low-Btu gasification processe and coal-fired utility solid wastes. Th three facilities from which solid waste were obtained used the same lignit feedstock. Also presented are compara ble RCRA leachate results of soli wastes from a medium-Btu gasificatio process and a coal-fired power plan both fueled with identical lignit feedstocks. The results indicate thi solid wastes from coal-fired utilities ar those generated directly by low- ar medium-Btu gasification processes a nonhazardous according to RCR protocol and limits.

Characterization of Solid Wastes from Indirect Liquefaction Facilities

C.A. Hunter, K.Y.Yu, and K.W. Crawford, TRW
Redondo Beach, CA 90278

Gasification ash and slag are the major solid wastes generated in indirect coal liquefaction facilities. Smaller amounts of spent catalysts and pollution control sludges may also be generated. There is a limited amount of data on the hazardous and nonhazardous characteristics of these solid wastes. Leachate data for gasifier ash and slag from Lurgi, Wellman-Galusha, and Texaco gasification have been presented elsewhere. The RCRA leaching characteristics of quenched gasifier slag and dust from commercial scale Koppers-Totzek gasification tests in Greece are presented in this paper. The potential accumulation of trace elements in the sludges from biological oxidation of Lurgi gasification condensates are estimated. Koppers-Totzek and Texaco gasification condensates will contain negligible amounts of organics (compared to the Lurgi gasification condensates) and will not require biological oxidation. The potential accumulation of trace elements on high temperature shift catalyst are examined as a function of degree of gasification and feed coal characteristics.

Ash/Slag Residuals and Wastewater Treatment Plant Sludges from Synfuels Facilities: Characterizations and Implications for Disposal

R.D. Neufeld, G. Keleti, J. Bern, C. Moretti, S. Wallach, and H. Erdogen
University of Pittsburgh
Pittsburgh, PA 15261

This paper gives an overview of research conducted at the University of Pittsburgh in the area of coal conversion ash and slag. Residuals were obtained from the GFETC "slagging Lurgi type" gasifier (two different runs), METC (Wellman-Galusha type) pressurized gasifier, DOE-Chapman gasifier fly ash, and two H-Coal vacuum bottoms residuals. A first screen bioassay of SRC-II Fort Lewis coal liquefaction residuals and sludges is also presented. In addition, research has been conducted at the University of Pittsburgh for the past few years in the area of developing a stable pretreatment and biological treatment facility for the processing of phenolic type coal gasification wastewaters. During the processing of wastewaters, sludges are produced which are assessed for toxicity, mutagenicity, and overall disposability.

Update on EPA's Regulatory Views on Coal Conversion Solid Wastes

Y.M. Garbe, U.S. EPA
Washington, DC 20460

The Resource Conservation and Recovery Act of 1976 (RCRA) charges EPA with the responsibility for establishing a program for the management of hazardous solid wastes. This paper summarizes current and anticipated RCRA regulations affecting the synfuels industry. Included in the various RCRA issues pertaining to the synfuels industry is a discussion of the RCRA mining exemption. An overview is given of the Office of Solid Waste's planned research activities to support future synfuels solid waste regulations.

(Only the abstract is published in the proceedings.)

Session V. Multimedia Environmental Considerations

A Permitter's View of Synfuel Commercialization

G.L. Harlow, U.S. EPA Region 4
Atlanta, GA 30365

The EPA is responsible for issuing permits to synfuels plants for the control of various liquid, gaseous, and solid waste streams. These permits comprise the Prevention of Significant Deterioration (PSD) under the Clean Air Act of 1977, the National Pollutant Discharge Elimination System (NPDES) and the Section 404 Dredge and Fill permits under the Clean Water Act of 1977, and the hazardous waste permits under the Resource Conservation and Recovery Act (RCRA) of 1976.

Since there will likely not be federal regulations established by EPA setting standards on requirements for first-generation synfuels plants, the environmental permits will have to be individually negotiated, case by case, with each applicant using best engineering practice. This places an unusual burden on the permit writer who will be negotiating with the discharger from an uninformed and defenseless position. To overcome this burden and to avoid long, time-consuming delays in the permit process, the company should disclose in its application for permit exactly what steps will be taken to control air emissions, water discharges, and hazardous wastes.

(Only the abstract is published in the proceedings.)

Comparison of Environmental Design Aspects of Some Lurgi-Based Synfuels Plants

M.R. Beychok, Consultant
Irvine, CA 92715

W.J. Rhodes, Industrial Environmental Research Laboratory, U.S. EPA
Research Triangle Park, NC 27711

This paper summarizes the current status of proposed projects in the U.S. which involve synfuels production based on utilizing Lurgi coal gasification technology.

For some Lurgi-based synfuel projects where actual plant design information has been made available, a comparison of their environmental designs is discussed. The primary focus of the environmental design comparison is on the facilities to be included for the control and abatement of air pollutant emissions and wastewater pollutant discharges. Insofar as possible, the paper also focuses on commercial-scale project designs.

Session VI. Product-Related Environmental Considerations

Risk Assessment of Synfuel Technology

A.A. Moghissi, U.S. EPA
Washington, DC 20460

(No paper or abstract available.)

Premanufacture Review of Synfuels Under TSCA

M. Hale, Jr. and C. Mazza
U.S. EPA
Washington, DC 20460

The Toxic Substances Control Act (TSCA) requires manufacturers to notify EPA at least 90 days before they

produce a new chemical substance for commercial purposes. Once notified, EPA has 90 days, extendable for good cause to 180 days, to review the chemical. During the review period, the Agency can act to prohibit or limit the manufacture, processing, or use of a new chemical substance where it finds that the information available on the substance is insufficient for a reasoned evaluation of its risks and that (1) the chemical may present an unreasonable risk to human health or the environment or (2) significant human or environmental exposure can reasonably be expected. Certain synthetic fuel products (including certain by-products and intermediates) may be new chemical substances under TSCA and therefore potentially subject to premanufacture notice requirements. This paper outlines TSCA premanufacture notification requirements; it describes how "new" chemical substances are defined; and it discusses the types of data that might be provided to EPA with a premanufacture notice on a synfuel.

Methanol as a Clean Major Fuel

P.W. Spaite, Consultant
Cincinnati, OH 45213

Methanol is considered as an alternative fuel that could be produced using available technology to displace major petroleum fuels in a relatively short time. The major factors considered are:

1. Potential environmental consequences of introducing methanol.
2. Status of development of methanol fuel technology.
3. Cost and efficiency of synfuels processes.
4. Potential markets.
5. Prospects of commercialization of methanol fuels.

The paper develops an overview perspective by identifying all important factors in each category and presenting enough quantitative data to permit relative comparisons without excessive detail.

Methanol as an Alternative Transportation Fuel

R. Rykowski, R.D. Atkinson, D. Heiser, J. McGuckin, D. Pletcher, J. Alson, and M. Rosenfeld, U.S. EPA
Ann Arbor, MI 48105

Over the remaining years of this century, synthetic fuels will play a key role in the nation's drive for energy independence. Although self-reliance is indeed a desirable goal, many people believe that it cannot be achieved without significant compromises in environmental quality. This may not be the case. One synfuel, methanol, could be used to replace both gasoline and diesel fuel and yield environmental benefits. This paper compares methanol with synthetic fuels from other coal liquefaction processes in terms of the environmental and economic consequences of their use.

Project Summary—A Compendium of Synfuel End Use Testing Programs

M. Ghassemi, S.C. Quinlivan, and M. Haro, TRW
Redondo Beach, CA 90278

A "Compendium of Synfuel End Use Testing Programs," which provides information on major recently completed, current, and planned synfuels end use testing projects, has been developed. The compendium is intended to promote flow of information among various synfuels testing programs, thereby reducing chances for duplication of effort and enabling design and implementation of cost-effective and systematic approaches to the collection of appropriate environmental data in conjunction with ongoing and planned performance testing projects. EPA intends to update this compendium to include results from current and future testing programs.

Projects described in the compendium involve testing of shale-derived fuels, SRC-II middle distillates, EDS fuel oils, H-coal liquids, and methanol/indolene mixtures in various equipment such as utility boilers, steam generators, diesel engines (laboratory-and full-scale), auto engines, and various other combustors. Published reports on various testing efforts and discussions with test sponsors/contractors are the sources of data for the compendium.

Based on the data in this compendium, the thrust of the synfuels testing program which has been carried out to date has been to assess equipment performance and fuel handling characteristics. Where some emissions monitoring has been conducted, such efforts have been limited in scope and have primarily emphasized measurement of criteria pollutants (NO_x, SO_x, particulates, etc.). Essentially no data have been collected on emissions of noncriteria/nonregulated pollutants.

Comparative Testing of Emissions from Combustion of Synthetic and Petroleum Fuels

W.G. Tucker and J.A. McSorley, Industrial Environmental Research Laboratory, U.S. EPA
Research Triangle Park, NC 27711

Procedures are being developed for the comparative testing of combustion products from liquid synthetic fuels and petroleum-based analogs. Combustion tests at EPA's research facility in North Carolina are measuring differences in emissions from petroleum-, coal-, and shale-derived fuels in stationary combustors. Data from these tests will be used in refining procedural guidance on combustion testing of synfuels for Premanufacturing Notice (PMN) applications.

Unpresented Papers

Two papers, not presented at the symposium, are published in the proceedings.

Problems Associated with the Analysis of Synfuels Product Process, and Wastewater Streams

H.C. Higman, D.K. Rohrbaugh, R.H. Colleton, and R.A. Auel
Hittman Associates, Inc.
Columbia, MD 21045

Hittman Associates, as part of an environmental assessment of coliquefaction technology sponsored the U.S. EPA, performed various analyses on samples from the Solvent Refined Coal II (SRC-II) plant in Lewis, WA, and the Exxon Donor Solvent (EDS) plant in Baytown, TX. The paper describes several problems encountered in these analyses and methods taken to mitigate them. Recommendations are made on approaches for avoiding such problems.

Solvent Extraction Processing for Coal Conversion Wastewaters

J.R. Campbell and R.G. Luthy,
Carnegie-Mellon University
Pittsburgh, PA 15213

M.J.T. Corrondo, New
University of Lisbon
Lisboa, Portugal

This paper outlines experimental and modeling techniques being used to evaluate solvent extraction processing of coal conversion wastewaters. The project includes characterization of organic contaminants in slagging fixed-bed gasification process wastewater, as well as screening studies to evaluate removal efficiencies for these contaminants. Experiments are also in progress to measure distribution coefficients for several solvent types with phenol and representative base- and neutral-fraction aromatic solutes. These experiments are being performed with both clean water and wastewater systems. Results from these experiments are being evaluated in light of three techniques for estimating distribution coefficients: modified regular solution theory as used in chemical engineering processing, expanded solubility parameter approach as used in liquid-liquid chromatography, and estimation of octanol-water partition coefficient as employed in environmental science. This paper reviews results obtained to date and explains direction for work during the coming year.

F.A. Ayer and N.S. Jones are with Research Triangle Institute, P.O. Box 12194, Research Triangle Park, NC 27709
***N. Dean Smith** is the EPA Project Officer (see below).*
The complete report, entitled "Proceedings: Symposium on Environmental Aspects of Fuel Conversion Technology--VI, A Symposium on Coal-Based Synfuels--October 1981," (Order No. PB 83-128 181; Cost: $40.00; subject to change) will be available only from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650
The EPA Project Officer can be contacted at:
Industrial Environmental Research Laboratory
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

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