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U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY  
REGIONAL DIVISION-SOUTH  
FORT MCPHERSON, GEORGIA 30330

REPLY TO  
ATTENTION OF

HSHB-MS-E

29 JUL 1982

SUBJECT: Water Quality Information Paper No. 14

NONPOINT POLLUTION SOURCES AND CONTROL

1. PURPOSE. The purpose of this information paper is to provide current information and guidance to all US Army commands concerned with the various aspects of nonpoint water pollution that may be associated with their activities.

2. REFERENCES. See Inclosure 1 for a listing of references. Section 1 pertains to references utilized in preparing this paper; Section 2 contains further suggested reading.

3. DEFINITIONS. Inevitably, any information paper dealing with water quality and pollution must begin by defining certain basic terms in order to preclude confusion. Frequently, common usage of basic terminology tends to blur the subtle differences in meaning between various terms, thus making discussion more difficult.

a. Water Quality. Water quality is a measure of a particular water's suitability for its intended use. Characteristics that make water unsuitable for a particular use, such as drinking, may be unimportant or even desirable to another, such as fishing and recreation.<sup>1</sup>

b. Water Pollution. The term "pollution" is derived from the Latin word "polluere," which means to soil or defile. Water pollution manifests itself through changes in water quality. There are numerous definitions for water pollution. One such definition is "...the presence of any foreign substance (organic, inorganic, radiological, or biological) which tends to degrade the water quality and constitute a hazard or impair the usefulness of the water."<sup>2</sup>

c. Standards and Criteria. Water quality and pollution are evaluated by comparing measured physical, chemical, biological, microbiological, and radiological quantities and parameters to a set of criteria and standards. A criterion is a scientific

<sup>1</sup>Clark, Viessman, and Hammer, Water and Supply and Pollution Control, International Textbook Co., Scranton, PA, 2nd ed., 1971, p. 228.

<sup>2</sup>Ibid, p. 237.

quantity upon which a judgement of water quality or pollution can be based. It is usually developed from scientific observations, such as morbidity or chronic toxicity data of various substances affecting man or aquatic life. A standard is set when a regulatory authority establishes any definite rule, principle, or measure concerning water quality or pollution, and is usually based upon criteria.

d. Nonpoint Pollution. Water pollution comes from two major causes: natural and cultural (those caused by man). Introduction of pollutants to a receiving surface water can either be from a point source or diffuse (nonpoint) source.

(1) Point Source. Point sources of pollution enter a receiving surface water at a discrete, identifiable location, such as an outfall pipe, and usually can be easily quantified as to amount and effects upon the receiving body of water.

(2) Nonpoint Source. Quantification of the amount and effects of pollution from nonpoint sources tends to be much more difficult than from point sources. Nonpoint pollution sources have three major characteristics: nonpoint source discharges enter receiving waters in a diffuse manner and at intermittent intervals that are dependent upon the occurrence of localized meteorological events; pollution arises over an extensive area of land and is in transit overland before entering the receiving surface water; nonpoint sources generally cannot be monitored at their origin, and their exact source is difficult or impossible to trace.

#### 4. NONPOINT SOURCES AND CONTROL.

a. Significance. Perhaps the greatest significance that can be attributed to nonpoint pollution is a realization of the fact that pollution from nonpoint sources, both natural and cultural, could stand in the way of achieving national water quality standard goals. In Section 101, "Declaration of Goals and Policy," of the Federal Water Pollution Control Act (FWPCA) Amendments of 1972, Public Law (PL) 92-500, it was stated that "it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water be achieved by July 1, 1983." The fact that the national water quality standard goal would not be met by

1983 due to nonpoint source pollution, was expressed by the Council on Environmental Quality in 1978.<sup>3</sup>

b. Magnitude. There are various opinions on the magnitude of nonpoint pollution impact upon surface waters in the US. For instance, it is estimated that nearly 90 percent of the 246 US Environmental Protection Agency (EPA) designated hydrological drainage basins are affected by nonpoint sources.<sup>4</sup> Even though nonpoint source water pollution may be less concentrated and conspicuous than from point sources, the following observations, made by Douglas Costle, former Administrator of the EPA, are presented to show that the overall impact from nonpoint sources is probably greater than from point source discharges.<sup>5</sup>

(1) Sediment. Sediment contributions from cultural (man-made) nonpoint sources are estimated to be 360 times greater than those from municipal and industrial point sources after treatment, and three times higher than those from natural background sources.

(2) Biochemical Oxygen Demand (BOD). BOD from man-made nonpoint sources is estimated to be five times higher than either treated point sources or natural background sources.

(3) Nitrogen and Phosphorus (N&P). Total nitrogen from man-made nonpoint sources is approximately four times higher than that from treated point sources and three times higher than from natural background sources. Total phosphorus from man-made nonpoint sources is slightly greater than from treated point sources and twice as high as natural background sources.

(4) Fecal Coliforms. Fecal coliform bacteria have been traditionally regarded as indicator organisms for contamination in water and wastewater treatment for many years. It is estimated that fecal coliform contributions to surface waters from nonpoint sources will be at least 50 times greater than from point sources, once secondary treatment and disinfection is achieved for all municipal sources.

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<sup>3</sup>US Environmental Protection Agency, Environmental Outlook - 1980, EPA 600/8-80-003, August 1980, p. 336.

<sup>4</sup>Ibid, p. 337.

<sup>5</sup>Ibid, p. 335-336.

c. Major Water Quality Legislation.

(1) FWPCA. In 1972, a major piece of legislation was enacted by Congress, entitled the "Federal Water Pollution Control Act Amendments of 1972," PL 92-500. This act extended Federal responsibilities for water pollution control to all US waters by establishing effluent limitations for various classes of discharges. Section 402 of this act requires the issuance of National Pollutant Discharge Elimination System (NPDES) permits for point source discharges in order to place effluent limitations on dischargers. Section 404 of this act required a permit from the Corps of Engineers for disposal of dredge and fill material into navigable waters. However, the significance of this act, as it relates to nonpoint pollution sources, is that Section 208 specifically addresses the control of nonpoint pollution. Section 208, entitled "Areawide Waste Treatment Management," requires the governor of each state to identify areas within their respective state that have substantial water quality control problems. Additionally, the governor must designate a single representative organization, including elected officials from local governments or their designees, that is capable of developing effective waste treatment management plans for such areas. In cases where substantial water quality control problems occur in an area located in two or more states, the governors of the respective states are to designate a single interstate representative organization to develop management plans for such areas. Existing regional planning agencies, at the time of enactment of the 1972 FWPCA Amendments, could be officially designated by the governor and fulfill the requirements of the Act. Agency designations, and plans that are formulated, are subject to approval by the administrator of the EPA. A discussion of the specific points to be addressed by the management plans follows:

(a) Areawide Waste Treatment Management Plans.

Section 208 of the FWPCA requires planning agencies to identify, if appropriate, all nonpoint sources within their jurisdiction. Additionally, the agency must set forth procedures and methods (including land use requirements) to control, to the extent feasible, such sources.

(b) Information and Guidelines. Section 304 of the FWPCA requires the EPA administrator to issue, to appropriate Federal agencies, the states, water pollution control agencies, and agencies designated under Section 208, information including (1) guidelines for identifying and evaluating the nature and extent of nonpoint source pollution and (2) processes,

procedures, and methods to control pollution from these sources. References 1 through 11, Section 2 of Inclosure 1, are examples of such guidance.

(2) Clean Water Act (CWA). On 27 December 1977, the FWPCA was further amended by the enactment of the "Clean Water Act," PL 95-217. This act modified the cleanup deadlines of 1972 FWPCA, identified new pollutant categories, and provided for the establishment of new technology-based effluent standards. Three agricultural pollution provisions were made in this act.<sup>6</sup> Irrigation return flows were exempted from the definition of "point source" and NPDES permit procedures. Secondly, normal farming, ranching, and forestry activities, done in accordance with best management practices established by a Section 208 plan, were exempted from NPDES and Section 404 permits. Thirdly, funds were authorized for assisting rural landowners in implementing best management practices on their lands to reduce nonpoint source pollution.

d. Nonpoint Sources. There are two main methods of organization for the discussion of nonpoint sources of pollution. One method would be to separately discuss each of the sources. However, sources of nonpoint pollution are more conveniently discussed in terms of the land use activities that produce various pollutants. The major land use activities contributing to nonpoint pollution include: urban development, agriculture, silviculture, construction, and mining.<sup>7</sup> As can be inferred from the above list, some land use activities, especially mining, would seldom be associated with US Army installations. A discussion of nonpoint sources and applicable regulations follows.

(1) Urban Development. Urban development greatly reduces natural soil absorption and percolation of precipitation due to large areas of impervious surfaces, such as building roofs and street surfaces. Thus, urban development results in abnormally large amounts of runoff as compared to areas of natural soil and vegetative cover. In order to facilitate discussion, three general types of discharges are loosely described with the term "urban runoff." The three types of urban runoff discharges are: combined sewer overflows, storm sewered runoff, and unsewered stormwater runoff. Cantonment areas of Army installations present many of the characteristics of urban areas.

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<sup>6</sup>US Environmental Protection Agency, A Guide to the Clean Water Act Amendments, OPA 129/8, November 1978, p. 15.

<sup>7</sup>Donigan, A.S., and Crawford, N.H., Modeling Nonpoint Pollution from the Land Surface, EPA 600/3-76-083, July 1976, p. 7.

(a) Characteristics. Approximately half of the 246 EPA-designated hydrological basins are polluted by urban runoff.<sup>8</sup> Many types of pollutants can be present in urban runoff. Suspended sediments and toxic substances, particularly heavy metals, are the most harmful; however, bacteria, oxygen-demanding materials, nutrients, and oil and grease are also problems. These pollutants in urban runoff come from air pollutants that settle in streets, organic debris, animal wastes, and discarded litter.<sup>9</sup>

(b) Structural and Nonstructural Controls. Nonstructural controls of urban runoff pollution focus on prevention and include measures such as land use planning, use of natural drainage patterns, erosion control, street repair and sweeping, and collection system maintenance. These controls are generally preferred to structural controls because of lower costs and better results.<sup>10</sup> Structural controls of urban runoff center on equalization reservoirs for storm water retention and conventional primary/secondary treatment.

(c) Regulations. Title 40, Code of Federal Regulations, Part 122.57 (40 CFR 122.57), 1981 revision, states that discharges from separate storm sewers are point sources subject to the NPDES permit program. However, the control of storm water flowing into storm sewers does not fall under any specific EPA effluent guidelines prior to collection.<sup>11</sup> Storm sewers may either be permitted individually or under a general permit. A separate storm sewer is defined as "a conveyance or system of conveyances (including pipes, conduits, ditches and channels) primarily used for collecting and conveying storm water runoff...."<sup>12</sup> The requirement for an individual NPDES permit applies to collection systems located in urbanized areas, as designated by the Bureau of the Census according to the criteria in 39 Federal Register, page 15202 (39 FR 15202) of May 1974. Storm water collection systems in rural areas may require an individual NPDES permit if the Director of a Section 208 planning agency designates the system as "separate." Additionally, conveyances which discharge process wastewater or storm water runoff contaminated with wastes, such as combined sewer overflows, require individual

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<sup>8</sup>USEPA, Environmental Outlook - 1980, p. 338.

<sup>9</sup>Ibid, p. 344.

<sup>10</sup>Ibid, p. 346.

<sup>11</sup>Ibid, p. 346.

<sup>12</sup>40 CFR 122.57(b)(1), 1981 revision.

NPDES permits. Systems in rural areas that are not designated by a Section 208 planning agency as separate, or are not combined systems, may only require general NPDES permits. See 40 CFR 122.59 for information on general permits.

(2) Agriculture. Agricultural activities include: irrigated and nonirrigated crop production; and confined and pastured animal production. Some areas of Army installations, such as leased cattle grazing lands, certainly fall under the definition of agricultural activities. In addition, agricultural/forestry reservations currently or previously used by the Army for training purposes may be considered in this category.

(a) Characteristics. More than two thirds of the EPA-designated hydrological basins are affected by agricultural runoff.<sup>13</sup> Pollutants resulting from crop production include sediments, nutrients, oxygen-demanding organics, and pesticides. Animal production can result in pollutant loads as nutrients, organic matter, and pastureland sediments.

(b) Best Management Practices. Control of agricultural runoff is primarily through best management practices rather than structural controls. Sediment loads from erosion can be reduced by use of terraces, diversions, strip cropping, contouring, grassed waterways, and/or crop rotation. Pesticide and nutrient (fertilizer) runoff loadings can be minimized by taking into consideration timing, type, amount, and application method. Specific Army nonpoint sources such as the aforementioned training areas can be controlled through the implementation of earthen embankments for channelization of area runoff and diversion ditches for natural runoff to avoid such disturbed areas.

(c) Regulations. As was mentioned previously, irrigation return flows from agriculture, and runoff from nonpoint agricultural activities such as orchards, cultivated crops, pastures, and range lands are excluded from NPDES permit requirements (see 40 CFR 122.51, 1981 revision). Concentrated animal feeding operations, as defined in 40 CFR 122.54, require an NPDES permit. In order to assist farmers and ranchers, the US Department of Agriculture (USDA) will provide partial funding for agricultural practices that reduce soil erosion and improve water quality. This funding is provided under the Rural Clean Water Program (RCWP), as authorized by the Agriculture, Rural Development and Related Agencies Appropriations Act (PL 96-108) of 1980. See Title 7, CFR, Part 700 for further details on the

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<sup>13</sup>USEPA, Environmental Outlook - 1980, p. 338.

RCWP. Soil erosion control is basically accomplished through a consortium of local, state, and Federal agencies. Local Soil and Water Conservation Districts (SWCD) are usually authorized and established under standard state enabling laws. The Soil Conservation Service, a sub-element of the USDA, provides Federal technical assistance to the local SWCD's.<sup>14</sup>

(3) **Silviculture.** Silvicultural activities are primarily concerned with the growing and harvesting of timber. Part 122.58 of 40 CFR defines silvicultural point and nonpoint sources. A silvicultural point source is the discharge of pollution into the US waters from any discernible, confined, and discrete conveyance related to rock crushing, gravel washing, log sorting, or log storage facilities that are operated in conjunction with silvicultural activities. These point sources are subject to the NPDES permit program. Typical nonpoint source silvicultural activities include nursery operations, site preparation, reforestation, thinning, prescribed burning, pest and fire control, harvesting, surface drainage, or road construction and maintenance from which there is natural runoff. It should be noted that some of the above activities, such as stream crossing for roads, may involve point source discharges or dredged or fill material which may require a Section 404 permit (see 40 CFR 123.91 and 33 CFR 209.120). The principal pollutants associated with silvicultural activities are sediments, organic matter, and pesticides. It is estimated that approximately 15 percent of the 246 EPA-designated hydrological basins are affected by silvicultural activities.<sup>15</sup>

(4) **Construction and Mixing.** These combined sources affect approximately 40 percent of all hydrological basins in the US.<sup>16</sup>

(a) **Construction.** Construction activities range from small scale residential construction to large scale projects such as highway, dam, and power plant construction. The primary types of pollutants associated with construction are soil sediments, chemicals used during and for construction, and miscellaneous construction debris. Petroleum products, pesticides, fertilizers, metals, soil additives, and other construction chemicals are possible pollutants that may be used on the construction site. The common pollution control methods consist of erosion prevention by establishing vegetative cover, and efficacious use of petroleum products, pesticides, fertilizers, etc.

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<sup>14</sup>Speitz, W.D., et al, Alternative Policies for Controlling Nonpoint Agricultural Sources of Water Pollution, EPA 600/5-78-005, April 1978, p. 5.

<sup>15</sup>USEPA, Environmental Outlook- 1980, p. 338.

<sup>16</sup>Ibid, p. 338.

(b) Mining. Surface mining is performed by various methods: strip, open pit, dredging, and hydraulic. The principal sources of water pollution are from mine drainage, and runoff/seepage from mine lands and waste piles. Drainage, runoff, and seepage may be laden with dissolved mineral wastes and suspended mineral debris. Mining activities can produce either point or nonpoint pollution sources, and the classification is sometimes difficult to ascertain. Control of water pollutants from certain parts of the mining site, such as disturbed land areas and refuse piles, is currently under state jurisdiction. Point sources are specifically controlled through NPDES permits.<sup>17</sup>

## 5. SUMMARY.

a. Characteristics. Nonpoint source discharges of pollution enter receiving waters in a diffuse manner and at intermittent intervals that are dependent upon the occurrence of localized meteorological events. Pollution arises over an extensive area of land and is in transit overland before entering the receiving surface water. Nonpoint sources generally cannot be monitored at their origin, and their exact source is difficult or impossible to trace.

b. Significance. It is estimated that nearly 90 percent of the 246 EPA-designated hydrological drainage basins are affected by nonpoint sources, and that the overall impact from nonpoint sources is probably greater than that from point sources.

c. Major Nonpoint Sources. The major land use activities that frequently result in nonpoint source pollution include: urban development, agriculture, silviculture, construction, and mining.

d. Water Quality Legislation. The 1972 FWPCA was the first major legislation to address the control on nonpoint sources of pollution. Section 208 of the act required the establishment of regional planning agencies for the control of all nonpoint pollution sources in areas with substantial water quality problems. The 1977 CWA made several agricultural nonpoint source provisions. Irrigation return flows were exempted from NPDES permit requirements; grants were made to assist normal farming, ranching, and forestry activities with the implementation of best management practices to reduce water pollution.

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<sup>17</sup>USEPA, Environmental Outlook - 1980, p. 338.

e. NPDES Permits. Classical sources of nonpoint pollution require NPDES permits if the discharge is channelized in some manner and then discharged from a point. Separate storm sewers in urban areas, concentrated animal feeding operations, log sorting and storage activities, and point discharges from mining activities are all subject to NPDES permit requirements.

6. RECOMMENDATIONS.

a. US Army installations and activities concerned with nonpoint source pollution effects should consult with the Section 208 regional planning agency that has jurisdiction over that region. Implementation of waste treatment management plans for the control of nonpoint sources of pollution should then be initiated and included in installation master plans.

b. Permits for point source discharges resulting from land use activities commonly associated with nonpoint pollution, such as separate storm sewers for urbanized areas, should be obtained from the regulatory authority with jurisdiction.

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REFERENCES

SECTION 1

1. Federal Water Pollution Control Act Amendments of 1972, PL 92-500, 18 October 1972.
2. Title 7, Code of Federal Regulations (CFR), Part 700, 1980, Rural Clean Water Program, 1981 revision.
3. Title 40, CFR, Part 122, EPA Administered Programs: The National Pollutant Discharge Elimination System; The Hazardous Waste Permit Program; and the Underground Injection Control Program, 1981 revision.
4. US Environmental Protection Agency (USEPA), Environmental Outlook - 1980, EPA 600/8-80-003, USEPA, Office of Research and Development, Washington, DC, August 1980.
5. USEPA, A Guide to the Clean Water Act Amendments, OPA 129/8, USEPA, Office of Public Awareness, Washington, DC, November 1978.
6. Speitz, W.D., et al, Alternative Policies for Controlling Nonpoint Agricultural Sources of Water Pollution, EPA 600/5-78-005, USEPA, Washington, DC, April 1978.
7. Donigan, A.S., and Crawford, N.H., Modeling Nonpoint Pollution from the Land Surface, EPA 600/3-76-083, USEPA, Office of Research and Development, Environmental Research Laboratory, Athens, Georgia, July 1976.
8. Clark, J.W., Viessman, W., and Hammer, M.J., Water Supply and Pollution Control, 2nd edition, International Textbook Co., Scranton, PA, 1971.

REFERENCES

SECTION 1

1. Federal Water Pollution Control Act Amendments of 1972, PL 92-500, 18 October 1972.
2. Title V, Code of Federal Regulations (CFR), Part 700, 1980, National Clean Water Program, 1981 revision.
3. Title 40, CFR, Part 122, EPA Administered Program: The National Pollutant Discharge Elimination System; The National Waste Tonnage Program; and the Underground Injection Control Program, 1981 revision.
4. US Environmental Protection Agency (USEPA), Environmental Outlook - 1980, EPA 600/8-80-003, USEPA, Office of Research and Development, Washington, DC, August 1980.
5. USEPA, A Guide to the Clean Water Act Amendments, CWA 1972, USEPA, Office of Public Awareness, Washington, DC, November 1978.
6. Speltz, W.D., et al., Alternative Policies for Controlling Nonpoint Agricultural Sources of Water Pollution, EPA 600/3-78-002, USEPA, Washington, DC, April 1978.
7. Donigan, A.S., and Crawford, M.H., Modeling Nonpoint Pollution from the Land Surface, EPA 600/3-78-033, USEPA, Office of Research and Development, Environmental Research Laboratory, Athens, Georgia, July 1978.
8. Clark, J.W., Vlasman, W., and Renner, M.L., Water Supply and Pollution Control, 2nd edition, International Textbook Co., Scarborough, PA, 1971.

SECTION 2

1. Deeley, D., Water Quality Management Guidance for Mine Related Pollution Sources, EPA Technical Guidance Memorandum, Tech 42, December 1977.
2. Heavy, J., et al. Nationwide Evaluation of Combined Sewer Overflows and Urban Stormwater Discharges, Volume II: Cost Assessment and Impacts, EPA 600/2/77-064, March 1977.
3. Metcalf and Eddy, Inc., Urban Stormwater Management and Technology: Update and User's Guide, EPA 660/8/77-014, 1977.
4. Thranson, R.E., Nonpoint Source Control Guidance: Construction, EPA Technical Memorandum TECH 27, December 1976.
5. Nonpoint Source Control Guidance: Agricultural Activities, EPA 440/3-78-001, February 1978.
6. US Environmental Protection Agency, The Control of Pollution from Hydrographic Modifications, EPA 430/9-73-017, Washington, DC: US Government Printing Office, October 1973.
7. Methods for Identifying and Evaluating the Nature and Extent of Nonpoint Sources of Pollutants, EPA 430/9-73-014, Washington, DC: US Government Printing Office, October 1973.
8. Processes, Procedures and Methods to Control Pollution from Mining Activities, EPA 430/9-73-011, Washington, DC: US Government Printing Office, 1973.
9. US Environmental Protection Agency and US Department of Agriculture, Control of Water Pollution from Cropland: Volume II: An Overview, EPA 600/2-75-026(b), Washington, DC: US Government Printing Office, June 1976.
10. Guidelines for Areawide Waste Treatment Management Planning, Environmental Protection Agency, Washington, DC, August 1975.
11. Colston, N.V., Characterization and Treatment of Urban Land Runoff, Office of Research and Development, Environmental Protection Agency, Cincinnati, Ohio, EPA 670/2-74-096, December 1974.

SECTION 2

1. Daley, D., Water Quality Management Guidance for Mine Related Volatile Sources, EPA Technical Guidance Memorandum, Tech 41, December 1977.
2. Heavy, J., et al. Nationwide Evaluation of Combined Sewer Overflows and Urban Stormwater Discharges, Volume 1: Cost Assessment and Impacts, EPA 600/2-77-084, March 1977.
3. Maccelli and Eddy, Inc., Urban Stormwater Management and Technology: Update and User's Guide, EPA 600/8-77-014, 1977.
4. Thompson, R.E., Nonpoint Source Control Guidance: Construction, EPA Technical Memorandum TCM 31, December 1976.
5. Nonpoint Source Control Guidance: Agricultural Activities, EPA 400/1-75-001, February 1978.
6. US Environmental Protection Agency, The Control of Pollution from Hydrographic Modifications, EPA 430/2-75-017, Washington, DC: US Government Printing Office, October 1973.
7. Methods for Identifying and Evaluating the Nature and Extent of Nonpoint Sources of Pollution, EPA 430/2-75-014, Washington, DC: US Government Printing Office, October 1973.
8. Procedures, Procedures and Methods to Control Pollution from Water Activities, EPA 430/2-75-011, Washington, DC: US Government Printing Office, 1973.
9. US Environmental Protection Agency and US Department of Agriculture, Control of Water Pollution from Cropland: Volume I: An Overview, EPA 600/1-75-018(a), Washington, DC: US Government Printing Office, June 1978.
10. Guidelines for Arsenide Waste Treatment Management Planning, Environmental Protection Agency, Washington, DC, August 1973.
11. Cofman, N.V., Characterization and Treatment of Urban Landfills, Office of Research and Development, Environmental Protection Agency, Cincinnati, Ohio, EPA 610/2-74-026, December 1974.