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Program

ABSTRACTS AND PARAMETER INDEX DATABASE FOR REPORTS PERTAINING TO THE UNSATURATED ZONE AND SURFACE WATER-GROUND WATER INTERACTIONS AT THE IDAHO NATIONAL ENGINEERING LABORATORY

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INTRODUCTION

This report is a product generated by faculty at the University of Idaho in support of research and development projects on Unsaturated Zone Contamination and Transport Processes, and on Surface Water-Groundwater Interactions and Regional Groundwater Flow at the Idaho National Engineering Laboratory. These projects are managed by the State of Idaho's INEL Oversight Program under a grant from the U.S. Department of Energy.

In particular, this report meets project objectives to produce a site-wide summary of hydrological information based on a literature search and review of field, laboratory and modeling studies at INEL, including a cross-referenced index to site-specific physical, chemical, mineralogic, geologic and hydrologic parameters determined from these studies.

This report includes abstracts of 149 reports with hydrological information. For reports which focus on hydrological issues, the abstracts are taken directly from those reports; for reports dealing with a variety of issues beside hydrology, the abstracts were generated by the University of Idaho authors concentrating on hydrology-related issues.

Each abstract is followed by a "Data" section which identifies types of technical information included in a given report, such as information on parameters or chemistry, mineralogy, stream flows, water levels. The "Data" section does not include actual values or data.

A companion report by L. Flint Hall, "User's Guide: Database of Literature Pertaining to the Unsaturated Zone and Surface Water-Groundwater Interactions at the INEL" (INEL Oversight Program Technical Report OPTR 93-02) provides information on computerized access to and searching capabilities for the literature abstracts and the cross-referenced technical information (e.g., types of parameters and data) from those abstracts. The work by Hall also includes a bibliographic listing of all literature abstracted for this report.

Adamic, M.L., J.R. Burr and G.J. McManus, 1984. Baseline Levels of Controlled Pollutants in the Vicinity of ICPP Processes; Westinghouse Idaho Nuclear Company, Inc., WINCO-1018, 52 pages.

Abstract or Summary:

In this study, baseline levels of controlled pollutants at the ICPP were determined. Pollutants included in this study were: hydrogen sulfide, sulfur dioxide, non-methane hydrocarbons, particulates, mercury and cadmium.

Data:

air quality: concentration, hydrogen sulfide, sulfur dioxide, non- methane hydrocarbons, total suspended particulate, suspended mercury, suspended cadmium. precipitation: concentration, sulfide, mercury, cadmium, pH. surface soil: concentration, cadmium, mercury

Anderson, S.R., 1991. Stratigraphy of the Unsaturated Zone and Uppermost Part of the Snake River Plain Aquifer at the Idaho Chemical Processing Plant and Test Reactors Area, Idaho National Engineering Laboratory, Idaho; U.S. Geological Survey, DOE/ID-22095, 71 pages.

Abstract or Summary:

A complex sequence of basalt flows and sedimentary interbeds underlies the Idaho Chemical Processing Plant and Test Reactors Area at the Idaho National Engineering Laboratory in eastern Idaho. Wells drilled to a depth of 700 feet penetrate a sequence of 23 basalt-flow groups and 15 to 20 sedimentary interbeds that range in age from about 200,000 to 640,000 years. The 23 flow groups consist of about 40 separate basalt flows and flow units. Each flow group consists of one to three petrographically similar basalt flows that erupted from related source areas during periods of less than 200 years. Sedimentary interbeds consist of fluvial, lacustrine, and eolian deposits of clay, silt, sand, and gravel that accumulated during periods of volcanic inactivity ranging from thousands to hundreds of thousands of years. Multiple flow groups and sedimentary interbeds of similar age and source form seven composite stratigraphic units with distinct upper and lower contacts. Composite units older than about 350,000 years were tilted, folded, and fractured by differential subsidence and uplift. Basalt and sediment of this sequence are unsaturated and make up the uppermost part of the Snake River Plain aquifer. Stratigraphic relations in the lowermost part of the aquifer below a depth of 700 feet are uncertain. This undifferentiated sequence of basalt and sediment is penetrated by only 17 of the 79 wells in the area and has not been evaluated for stratigraphic properties because of insufficient data. Only one well may penetrate the effective base of the aquifer at a depth of 1,200 feet below land surface. The areal extent of basalt-flow groups and sedimentary interbeds in the upper 700 feet of the unsaturated zone and aquifer was determined from geophysical logs, lithologic logs, and well cores. Basalt flows in the cores were evaluated for potassium-argon ages, paleomagnetic properties, and petrographic characteristics. Stratigraphic control was provided by a sequence of basalt flows with reversed paleomagnetic polarity and high emission of natural-gamma radiation compared to other flows; the control was supplemented by distinct changes in natural-gamma radiation across the contacts of each of the seven composite stratigraphic units. Natural-gamma logs were used as a primary tool for stratigraphic correlations. Natural-gamma emissions generally are uniform in related, petrographically similar basalt flows and generally increase or decrease between petrographically dissimilar flows of different age and source.

Data:

basalt: flow groups, thickness, altitude. aquifer: thickness, depth. stratigraphy: generalized. well logs. sediment: thickness, altitude.

Anderson, S.R. and B.D. Lewis, 1989. Stratigraphy of the Unsaturated Zone at the Radioactive Waste Management Complex, Idaho National Engineering Laboratory, Idaho; U.S. Geological Survey, DOE/ID-22080, 54 pages.

Abstract or Summary:

A complex sequence of layered basalt flows, cinders, and sediment underlies the RWMC. Wells drilled to 700 feet penetrate a sequence of 10 basalt-flow groups and 7 major sedimentary interbeds that range in age from about 100,000 to 600,000 years old. The 10 flow groups consist of 22 separate lava flows and flow-units. Each flow group consists of from one to five petrographically similar flows that erupted from common source areas during periods of volcanic inactivity ranging from thousands to hundreds of thousands of years. Flows and sediment are unsaturated to a depth of about 600 feet. Flows and sediment below a depth of 600 feet are saturated and make up the uppermost part of the Snake River Plain aquifer. The areal extent of flow groups and interbeds was determined from well cuttings, cores, geophysical logs, potassium-argon ages, and geomagnetic properties. Stratigraphic control was provided by four flows near the base of the unsaturated zone that have reversed geomagnetic polarity and high emission of natural gamma radiation compared to other flows. Natural gamma logs were used as a primary correlation tool.

Data:

liquid waste: volumes, source, types, radioactivity. basalt: flow group, thickness, altitude. sedimentary interbed: thickness, altitude.

Ansley, S.L., 1990. Sampling and Analysis Plan for the Hydrogeologic Characterization of the Interbed Soil Beneath CFA Landfills II and III; EG&G Idaho, Inc., EGG-ER-8721 Rev.2, 57 pages.

Abstract or Summary:

This sampling and analysis plan is part of an investigation in response to requirements of 40 CFR 265.90 Subpart F (regulations for groundwater monitoring at landfills) and is governed by hazardous waste regulations promulgated under the Resource Conservation and Recovery Act (RCRA). These regulations require that all Land Disposal Units (LDU) operated after November, 1980, have a groundwater monitoring system to detect possible release of hazardous constituents into the environment. The collection of site-specific data, describing the hydrologic, mineralogic, and geochemical properties of the sedimentary interbed between the first and second layers of basalt at CFA landfill II, is necessary to better understand the hydrologic and contaminant transport processes beneath the landfill. For all sampling and analysis efforts, each monitoring well drilled around the landfills will have samples collected from the first interbed, located from 50-70 feet below land surface, for characterization. One sample will be taken from the top, middle, and bottom of the interbed, and analyzed for its hydrologic, mineralogic, and geochemical properties as described in this plan. This plan includes the sampling objectives, project organization and responsibility, sampling strategy and procedures, sample control and document management, equipment, analytical procedures, data management, quality assurance, and safety and training.

Data:

Hydrologic properties, mineralogical properties, geochemical properties.

Ansley, S.L., L.C. Hull and S.M. Burns, 1988. Shallow Drilling Report for CFA Landfills II and III - FY-1988; EG&G Idaho, Inc., EGG-ER-8291, 363 pages.

Abstract or Summary:

A shallow drilling program was implemented at the Central Facilities Area (CFA) Landfills II and III to define the geologic and hydrologic characteristics of the shallow surficial sediments at the landfills, to quantify the amounts and rates of water movement into and through the sediments, and to sample the sediments and soil gas for contaminants. In order to accomplish these goals, shallow boreholes were augered adjacent to the backfilled pit and trenches. The boreholes were instrumented with moisture-and contaminant-sensing probes and access ports. Sediment collected during the augering was analyzed for contamination, and soil gas samples were collected and analyzed. Additional and ongoing activities include materials testing and sediment samples and periodic reading of field instrumentation. Data from January through September 1988 indicate no significant water movement through the sediments below approximately 6 feet. However, calculations from neutron moisture probe data at a depth of 5.5 feet show an increase in moisture of about 0.22 inches from February to September 1988. Total precipitation from November 1987 to September 1988 was 3.77 inches so approximately 6% of the precipitation for that period entered the waste. Additional information from wetter years or artificially induced infiltration is needed to adequately assess the characteristics of water movement through the surficial material and into the basalt. Chemical analyses of soil samples indicated positive responses for acetone and methylene chloride. Since these constituents were detected in the associated blanks accompanying the samples during shipment, their presence and concentration levels do not imply that leachate is being generated from the buried waste. Gas sampling at the landfills showed positive results for methylene chloride, benzene, total hydrocarbons, and methane.

Data:

instrumentation, distribution coefficient, mineralogy, cation exchange capacity, grain size distribution, transmissivity, hydraulic conductivity, dispersivity, porosity, velocity, storage coefficient, borehole log, borehole completion diagrams. surficial sediment (landfill overburden): specific conductance, moisture content, capillary pressure profile, bulk density, porosity, specific gravity, hydraulic conductivity, grain size distribution, antimony, arsenic, lead, selenium, cadmium, aluminum, copper, iron, vanadium, volatile organics, semivolatile organics, pesticide organics. water quality: specific conductance. soil gas: concentration, chloroform, dichloromethane, trichloroethane, carbon tetrachloride, trichloroethene, perchloroethylene, methane, benzene, total hydrocarbons.

Armstrong, R.L., W.P. Leeman and H.E. Malde, 1975. K-Ar Dating of Quaternary and Neogene Volcanic Rocks of the Snake River Plain, Idaho; American Journal of Science, Volume 275, p. 225-251, 8 pages.

Abstract or Summary:

98 K-Ar dates for lavas of the Snake River Plain (SRP) and vicinity provided calibration for the stratigraphic framework discussed by Malde and Powers (1962). The Idavada volcanics, predominantly silicic volcanic rocks, are 9-12 million years old in the western SRP; rocks of similar type and comparable stratigraphic position are 8-10 million years old in the central SRP and as young as 4-5 million years old in the eastern SRP. This time transgressive silicic volcanic assemblage emerges in the east with the silicic volcanic units erupted during the last two million years from Island Park, Yellowstone and related volcanic centers. General facies relations in the SRP for the last 10 million years have been from east to west or oldest to youngest in any local section: a. Silicic volcanic rock, mostly ash flow deposits with minor basalt and sediment intercalations; b. Basalt flows with minor intercalated sediment and local silicic domes; and c. Lacustrine and fluvial sediments completely interstratified with basalt flows. These facies have shifted eastward across Idaho in a reasonably systematic manner at the rate of approximately 1° of longitude per 2,000,000 years, approximately 3.5 centimeters per year. Bear River may have been diverted into Lake Bonneville 0.1 million years ago rather than 0.03 million years ago as dated by radio carbon.

Data:

Basalt dating, K-Ar dating, radiometric dating

Baca, R.G., S.O. Magnuson, H.D. Nguyen and P. Martin, 1992. A Modeling Study of Water Flow in The Vadose Zone Beneath the Radioactive Waste Management Complex; EG&G Idaho, Inc., EGG-GEO-10068, 74 pages.

Abstract or Summary:

A numerical modeling study was conducted to investigate: (1) relationship between meteorologic conditions and net infiltration, (2) water movements after floods, and (3) water travel time in the vadose zone. The processes modeled include precipitation, evaporation, infiltration, and soil-moisture redistribution. The time periods covered are 1955-1964 and 1984-1990. The infiltration patterns for both the undisturbed and the pit/trench cover materials were calculated. It was concluded that 10 cm/yr or greater would be a conservative bound for the average annual infiltration rate. Detailed simulation of the 1969 flooding of Pit 10 was made. The results indicate that the flooding front may have reached the 110 ft interbed within as little as 1 month time. Using a Monte Carlo simulation approach, the statistical distribution of water travel time exhibits a log-normal trend with a geometric mean travel time of 610 years. Simulation models used are: UNSAT-H, FLASH, PORFLOW, and FLOWMC.

Data:

basalt: thickness of flow elements, capillary pressure saturation curve, capillary pressure hydraulic conductivity curve. surficial sediment: capillary pressure hydraulic conductivity curve. sedimentary interbed: capillary pressure hydraulic conductivity curve. air temperature (including max and min daily values), cloud cover, relative humidity, wind velocity, precipitation, and solar radiation (generated data). modeling: parameters, results.

Baca, R.G., J.C. Walton, A.S. Rood and M.D. Otis, 1988. Organic Contaminant Released from a Mixed Waste Disposal Site: a Computer Simulation Study of Transport Through the Vadose Zone and Site Remediation; EG&G Idaho, Inc. Geosciences Group, 13 pages.

Abstract or Summary:

Problems with organic vapors have been noticed at waste disposal sites at several U.S. Department of Energy facilities. At the INEL, for example, problems with organic vapors have occurred at the Radioactive Waste Management Complex (RWMC). Analysis of soil gas samples and ground water samples indicate that organic vapors are being emitted from disposal pits in the Subsurface Disposal Area (SDA) of the RWMC. The primary source of the organic vapor has been determined to be organic waste as were disposed at the site in the mid 1960s. To address the organic problems at RWMC, a multi-task activity was initiated. The first task involved a record search to determine the quantities and distribution of organic wastes. The second task consisted of a detailed soil gas survey to identify the specific disposal areas that are producing the organic vapors. The third task involved the development and application of computer models. These activities provided much insight regarding the nature and extent of the organic vapor problem at the RWMC, as well as information on the possible remedial actions. This paper describes the technical approach and preliminary results from an ongoing computer modeling study of the organic vapor releases from the RWMC. The objectives of the study are (1) to develop an understanding of the release and transport processes and (2) to evaluate the effectiveness of possible remedial actions.

Data:

Surficial sediments, soil gas, carbontetrachloride, trichloroethane, trichloroethylene and tetrachloroethylene.

Bagby, J.C., L.J. White and R.G. Jensen, 1985. Water-Quality Data for Selected Wells on or near the Idaho National Engineering Laboratory, 1949 through 1982; U.S. Geological Survey, DOE/ID-22068, 800 pages.

Abstract or Summary:

During the past 34 years of INEL operations, radioactive and chemical wastes have been disposed to the Snake River Plain aquifer which underlies the INEL. Some of the wastes have been disposed to leaching ponds, ditches, or subsurface leaching fields, and evidence suggests that these wastes have migrated downward to the aquifer. Other wastes have reached the aquifer by direct injection through disposal wells. During the period from 1949 to 1982, several thousand water samples have been collected from an observation well network on the INEL. Water quality data from these wells have allowed scientists to observe, temporarily locate, and predict the future locations of waste plumes in the ground water. These data have been assembled on magnetic computer tape and are now available for comparison and evaluation of various digital ground water solute transport models. This report is a listing, in tabular form, of the water quality data available on magnetic tape. Included are water quality data for wells in the Snake River Plain aquifer on and near the INEL for the period 1949 through 1982. Maps showing the locations of the wells sampled are included, as well as a reference list of reports which interpret the data.

Data:

water quality: date, well, tritium, Sr-90, Co-60, Cr-51, I-129, Cs-137, Pu-238, Pu-239, Pu-240, Am-241, total chromium, specific conductance, sulfate, chloride, nitrate, and 28 other common chemical constituents.

Barraclough, J.T. and R.G. Jensen, 1976. Hydrologic Data for the Idaho National Engineering Laboratory Site, Idaho 1971 to 1973; U.S. Geological Survey, IDO-22055, 51 pages.

Abstract or Summary:

The chemical quality of the ground water in the Snake River Plain aquifer is the primary concern. Ground water samples were collected to determine the migration and the concentration of radioactive wastes in the subsurface. Water elevation fluctuations within both the regional and perched water systems were monitored and mapped. The Big Lost River brings considerable surface water onto the INEL during wet years. Recharge to the Snake River Plain aquifer from this flow has been significant. The average flow of the Big Lost River from 1965 through 1973 has been the highest for the period of record. The four years with the highest annual discharge occurred in 1965, 1969, 1967, and 1971, in order of decreasing discharge. Recharge from the Big Lost River and other streams to the north of INEL caused the water table in the aquifer to rise to record highs in 1972 or 1973 over much of the INEL. The water level in one well rose 21.5 feet from 1964 to 1972. This is the largest fluctuation of the water level in the Snake River Plain aquifer that has been observed at the INEL. The TRA utilizes ponds and a deep well to dispose of about 400 million gallons of dilute wastes per year. About half of the liquid waste is discharged to a radioactive waste pond. Infiltration from the pond has formed a large perched water body in the basalt. The perched ground water body contains tritium, Cr-51, Co-60, and Sr-90. The extent and concentrations of these radionuclides are shown on maps in this report. The ICPP discharges low-level radioactive waste and chemical waste directly into the Snake River Plain aquifer through a 600-foot disposal well. During 1971 to 1973, the well was used to dispose of 404 curies of radioactivity, of which 389 curies were tritium. The average yearly discharge was about 300 million gallons. The distribution of waste products in the aquifer covers about 15 square miles. Since disposal began in 1952, the wastes have migrated about 5 miles down gradient of the discharge points. Radionuclides are subject to radioactive decay, sorption, and dilution by dispersion in the aquifer. Chemical wastes are subject to sorption and dilution by dispersion. Waste plumes south of the ICPP containing tritium, sodium, and chloride have been mapped and all cover a similar area.

Data:

transmissivity, velocity, regional water table, pumpage, Big Lost River hydrograph, well hydrograph. perched water: TRA areal extent, altitude, well hydrograph, tritium, Cr-51, Co-60, Sr-90, specific conductance. liquid waste: radioactivity, tritium, Sr-90, Cs-137, Co-60, sodium chloride, sulfate, sulfite, phosphate, nitrate. water quality: distribution, concentration, tritium, Sr-90, Cs-137, Co-60, specific conductance, sodium.

Barraclough, J.T., B.D. Lewis and R.G. Jensen, 1981. Hydrologic Conditions at the Idaho National Engineering Laboratory, Idaho Emphasis: 1974-1978; U.S. Geological Survey, IDO-22060, 77 pages.

Abstract or Summary:

Low concentrations of aqueous chemical and radioactive wastes have been discharged to shallow ponds and to shallow or deep wells at the INEL since 1952. During the latest period of record, 1974 through 1978, the position of the regional water table has shown a net decline that ranges from 0.2 foot near the northern boundary of the INEL to more than 10 feet in the central and southern parts of the site. Recharge from surface water has been minimal or non-existent during the latter part of this period. A large body of perched ground water has formed in the basalt underlying the waste disposal ponds in the TRA. This perched zone contains tritium, Cr-51, Co-60, Sr-90, and several nonradioactive ions. Tritium is the only mappable waste constituent in that portion of the Snake River Plain aquifer directly underlying this perched zone. Low concentrations of chemical and low-level radioactive wastes enter directly into the Snake River Plain aquifer through the ICPP disposal well. From 1974 through 1978, this 600-foot well was used to discharge a total of 1,861 million gallons of waste water which contained 1,697 curies of radioactivity. Tritium has been discharged to the well since 1953 and has formed the largest waste plume, about 28 square miles in area, in the regional aquifer, and minute concentrations have migrated down gradient a horizontal distance of 7.5 miles. Other waste plumes south of the ICPP contain sodium, chloride, nitrate, and the resultant specific conductance. These plumes have similar configurations, flow southward, and the contaminants are in general laterally dispersed in that portion of the aquifer underlying the INEL. Other waste plumes, containing Sr-90, and I-129, cover small areas near their points of discharge because Sr-90 is sorbed from solution as it moves through the aquifer and I-129 is discharged in very low quantities. Cs-137 is also discharged through the well but it is strongly sorbed from solution.

Data:

regional water table, velocity, transmissivity, pumpage, Big Lost River hydrograph, well hydrograph. perched water: TRA areal extent, altitude, well hydrograph, Cr-51, Co-60, Sr-90, tritium, specific conductance, sodium, chromium, chloride, sulfate. water quality: distribution, concentration, tritium, Sr-90, I-129, specific conductance, sodium, chloride, nitrate. liquid waste: radioactivity, tritium, Sr-90, Cr-51, Cs-137, Co-60, Pu-238, Pu-239, Pu-240, I-129, sulfate, sodium, sulfite, phosphate.

Barraclough, J.T., J.B. Robertson, V.J. Janzer and L.G. Saindon, 1976. Hydrology of the Solid Waste Burial Ground, as Related to the Potential Migration of Radionuclides, Idaho National Engineering Laboratory; U.S. Geological Survey, IDO-22056, 183 pages.

Abstract or Summary:

Summarizes a study conducted at the RWMC to (1) evaluate the hydrologic, radiologic and geochemical variables that control the potential for subsurface migration of waste radionuclides from the burial trenches to the Snake River Plain aquifer; (2) to determine the extent of radionuclide migration, if any; and, (3) to construct monitoring wells into the aquifer. Four observation wells were drilled around the outside of the burial ground into the Snake River Plain aquifer to define subsurface geologic and hydrologic conditions, to monitor water level changes, and to collect water samples subsequently. Six additional observation wells were drilled within the burial ground to determine the subsurface geologic and hydrologic conditions and to detect radionuclides that may have migrated downward from the wastes in the burial ground. The thickness and extent of sedimentary layers interbedded with the basalt were determined by coring, sampling and logging wells drilled. The basalt and interflow sedimentary layers were cored at selected depths to obtain information on their hydraulic conductivity, mineralogy, and ion-exchange capacities, and were analyzed for radioactive waste constituents. Particular attention was given to the sampling of the sedimentary layers between the basalts because of their potential capacity to adsorb or filter dissolved and entrained wastes.

Data:

well completion, generalized lithology, gamma-ray log, gamma-gamma log, caliper log, neutron log, stratigraphy, grain size distribution, clay content, surficial sediment thickness, recharge, percolation, hydraulic conductivity, permeability, perched water, saturation. sedimentary interbed: thickness, altitude, K-40, Mn-54, Fe-59, Co-60, Zn-65, Sr-90, Cs-127, Zr-95, Nb-95, Ru-106, Ba-140, La-140, Ce-144, Bi-214, Pb-214, Ac-228, Th-232, Pu-232, Pu-238, Pu-239, Pu-240, Am-241, specific gravity, porosity, bulk density, moisture content, hydraulic conductivity, calcite, quartz, plagioclase, augite, olivine, chlorite, kaolinite, illite, montmorillonite, cation exchange capacity, gross gamma radioactivity. basalt: thickness, altitude. regional ground water: altitude, gradient, flow direction. water quality: tritium, K-40, Mn-54, Fe-59, Co-60, Zn-65, Sr-90, Cs-127, Zr-95, Nb-95, Ru-106, Ba-140, La-140, Ce-144, Bi-214, Pb-214, Ac-228, Th-232, Pu-232, Pu-238, Pu-239, Pu-240, Am-241, silica, aluminum, iron, manganese, calcium, magnesium, sodium, potassium, bicarbonate, carbonate, hydroxide, alkalinity, sulfate, chloride, fluoride, nitrate, ammonia nitrogen, organic nitrogen, ammonia, ortho phosphate, ortho phosphorus, dissolved solids, hardness, percent sodium, sodium adsorption ratio, specific conductance, temperature, pH, carbon dioxide, chromium, copper, lead. surficial sediment: Co-60, Sr-90, Cs-137, Pu-238, Pu-239, Pu-240, Am-241.

Barracclough, J.T., W.E. Teasdale and R.G. Jensen, 1967. Hydrology of the National Reactor Testing Station Idaho 1965; U.S. Geological Survey, IDO-22048, 107 pages.

Abstract or Summary:

This annual report describes a study to determine the effects of radioactive waste disposal to the basalts of the Snake River Plain aquifer. Ground and surface water samples were collected for chemical and radiologic analyses. The results were evaluated and mapped. Ground water levels were also monitored and mapped. Pumpage and waste disposal data are given. A record flood of the Big Lost River enabled recharge effects, infiltration rates, vertical percolation rates, and pressure transmission to be determined. Studies of air flow in the zone of aeration were continued. Study of in-well fluid flow showed that no consistent flow direction exists. The natural gamma spectra of rock were determined. Seismic effects on well hydrographs were evaluated. Effects of radioactive waste disposal to ponds and well are described and mapped. Tritium is the only waste radionuclide at NRTS that can be readily detected in ground water at significant distances from points of disposal. Tritium concentrations in ground water decreased principally because less waste was discharged. The tritium front in the aquifer lies about 4 miles south of the ICPP disposal well. Strontium-90 (Sr-90) has also been detected in ground water almost half a mile south of the disposal well.

Data:

regional water table, pumpage, Big Lost River hydrograph, infiltration rate, well hydrograph. water quality: areal extent, tritium, specific conductance. liquid waste: total radioactivity. perched water: TRA areal extent, altitude, well hydrograph.

Barraclough, J.T., W.E. Teasdale, J.B. Robertson and R.G. Jensen, 1967. Hydrology of the National Reactor Testing Station Idaho 1966; U.S. Geological Survey, IDO-22047-USGS, 95 pages.

Abstract or Summary:

Describes on-going studies to determine the hydrologic effects of disposal of radioactive waste to the ground at the NRTS. This has involved the collection and analyses of ground and surface water samples for radiologic and chemical changes. The results are evaluated and mapped. Ground water levels are also mapped for the NRTS. A record runoff of the Big Lost River during 1965 and 1966 induced a large amount of recharge to the Snake Plain aquifer. The recharge caused water levels to rise as much as six feet, but apparently did not have a great effect on the concentrations of waste products in the ground water. Pressure transmission, or mass transfer effects of the recharge, were observed as far as 50 miles southwest of the river. Tritium is the primary radioactive waste product discharged to the subsurface. Several aspects of tritium disposal have been studied in detail at the TRA. Waste tritium in water from the Snake Plain aquifer has been detected 4.5 miles south of the ICPP. Dissolved chromium has been used to trace TRA pond waste water in perched water bodies and downgradient 2.5 miles in the Snake Plain aquifer. A project to test the feasibility of disposing of radioactive gases into the ground is underway. A seismic survey was used to map the surface sediment thickness, and two test wells were cored to evaluate potential injection well sites. A "breathing well" was instrumented to study flow rate, temperature, humidity, and other aspects of vertical flow of air in the well. Results of the continuing study are presented. Studies made on several wells which had vertically flowing borehole water indicate that the physical and chemical properties of the water are influenced by the flow.

Data:

regional water table, water table fluctuation, well hydrograph, travel time contour, ground water velocity, air injection test. perched water: altitude in alluvium, altitude in basalt, tritium, specific conductance. water quality: specific conductance, sodium, chromium, Sr-90, gamma radioactivity, fluoride. caliper logs, gamma-ray logs, gamma-gamma logs, generalized lithology, borehole flow. well pumpage, Big Lost River discharge, diversion area storage capacity, infiltration rate. liquid waste: volume, tritium. aquifer air: discharge, temperature, relative humidity, barometric pressure. surficial sediment: Birch Creek Playa thickness.

Bartholomay, R.C., 1990. Mineralogical Correlation of Surficial Sediment from Area Drainages with Selected Sedimentary Interbeds at the INEL, Idaho; U.S. Geological Survey, DOE/ID-22092, 17 pages.

Abstract or Summary:

The U.S. Geological Survey's project office at the INEL used mineralogical data to correlate surficial sediment samples from the Big Lost River, Little Lost River, and Birch Creek drainages with selected sedimentary interbed core samples taken from test holes at the RWMC, TRA, ICPP, and TAN. Correlating the mineralogy of a particular present-day drainage area with a particular sedimentary interbed provides information on historical source of sediment interbeds in and near the INEL. Mineralogical data indicate that surficial sediment samples from the Big Lost River drainage contained a larger amount of feldspar and pyroxene and a smaller amount of calcite and dolomite than samples from the Little Lost River and Birch Creek drainages. Mineralogical data from sedimentary interbeds at the RWMC, TRA, and ICPP correlate with surficial sediment of the present-day Big Lost River drainage. Mineralogical data from a sedimentary interbed at TAN correlate with surficial sediment of the present-day Birch Creek drainage. This document describes the regional geology, stratigraphy, sediments, mineralogy, fractures, and hydrology of the RWMC area, as well as a brief description of the operation of the diversion ponds.

Data:

surficial sediment: bulk mineralogy. sedimentary interbed: mineralogy, quartz, plagioclase, feldspar, potassium feldspar, calcite, pyroxene, dolomite, detrital mica, total clay minerals.

Bartholomay, R.C. and L.L. Knobel, 1989. Mineralogy and Grain Size of Surficial Sediment from the Little Lost River and Birch Creek Drainages, Idaho National Engineering Laboratory, Idaho, Open-File Report 89-385; U.S. Geological Survey, DOE/ID-22082, 19 pages.

Abstract or Summary:

Thirteen samples of surficial sediment from the Little Lost River and Birch Creek drainages were collected for analysis of grain size distribution, bulk mineralogy, and clay mineralogy. Samples were collected from five sites in the channel of the Little Lost River, two sites from overbank deposits of the Little Lost River, five sites in the channel of Birch Creek, and one site from an overbank deposit of Birch Creek.

Data:

grain size distribution, bulk mineralogy, clay mineralogy, x-ray diffraction, quartz, plagioclase feldspar, potassium feldspar, calcite, pyroxene, dolomite, detrital mica, total clays, illite, smectite, kaolinite, mixed layer, chlorite, calcite.

Bartholomay, R.C., L.L. Knobel, and L.C. Davis, 1989. Mineralogy and Grain Size of Surficial Sediment from the Big Lost River Drainage and Vicinity, with Chemical and Physical Characteristics of Geologic Materials from Selected Sites at the Idaho National Engineering Laboratory, Idaho; U.S. Geological Survey, DOE/ID-22081, 74 pages.

Abstract or Summary:

Thirty-three samples of surficial sediment from the Big Lost River drainage and vicinity were collected for analysis of grain size distribution, bulk mineralogy, and clay mineralogy. Samples were collected from 11 sites in the Big Lost River channel, 5 sites in the Big Lost River overbank deposits, 6 sites in spreading areas that receive excess flow from the Big Lost River during peak flow conditions, 7 sites in the natural sinks and playas of the Big Lost River, 1 site in the Little Lost River Sinks, and 5 sites from other small, isolated closed basins. An additional 25 core samples from eight wells were analyzed for bulk and clay mineralogy. Nine samples were from basalt flows, 2 were from vesical fillings in basalt, 1 was from a fracture filling in basalt, and 13 were from sedimentary interbeds between basalt flows. Data on sediment and core characteristics that were previously published by the U.S. Geological Survey are also presented in this report. The data are distributed as follows: 328 cation exchange capacities, 6 bulk chemistry analyses and 1 average bulk chemistry of 38 basalt samples, 101 specific gravity analyses, 117 bulk mineralogy analyses, 56 silt mineralogy analyses, 204 clay mineralogy analyses, and 184 grain size analyses.

Data:

grain size distribution, bulk mineralogy: quartz, plagioclase, potassium feldspar, calcite, pyroxene, dolomite, detrital mica, olivine, hematite, total clays. clay mineralogy: smectite, kaolinite, illite, chlorite, quartz, feldspar, calcite.

Bennett, C.M., 1986. Capacity of the diversion channel below the flood-control dam on the Big Lost River at the INEL, Idaho; U.S. Geological Survey, DOE/ID-22071, 25 pages.

Abstract or Summary:

Stage-discharge relations were computed for two selected cross sections of a diversion channel at the INEL for discharges between 2,000 and 7,200 cfs. The channel diverts water from the Big Lost River into four spreading areas where the water infiltrates into the ground or evaporates. Computed water-surface profiles, based on channel conditions in the summer of 1985, indicate that the diversion channel will carry a maximum discharge of 7,200 cfs from the Big Lost River into the first spreading area. Backwater from the spreading areas is not expected to decrease the carrying capacity of the diversion channel. An additional 2,100 cfs will pass through two low swales west of the main channel for a combined maximum diversion capacity of 9,300 cfs.

Data:

stage-discharge relations, water surface profiles, channel cross sections, channel roughness coefficients.

Bennett, C.M., 1990. Streamflow losses and groundwater level changes along the Big Lost River at the INEL, Idaho; U.S. Geological Survey, DOE/ID-22091, 49 pages.

Abstract or Summary:

The Big Lost River flows onto the eastern Snake River Plain near Arco, Idaho, and across the INEL. Most streamflow infiltrates the bed of the river channel, INEL spreading areas A, B, C, and D, and playas located at the terminus of the river, to recharge the Snake River Plain aquifer. Average annual streamflow during 1965-1987 for the Big Lost River upstream from the INEL diversion dam was 104,400 AF; 52,000 AF were diverted to the spreading areas, 9,800 AF infiltrated between the INEL diversion dam and Lincoln Boulevard, and 42,600 AF infiltrated downstream from Lincoln Boulevard or flowed to playas. Evapotranspiration of streamflow was minor compared to infiltration losses. Losses were measured in selected reaches of the 44 miles of river from Arco to playa 1 at discharges that ranged from 37 to 372 cfs. Infiltration losses were from 1 to 2 cfs/mile at discharges less than 100 cfs throughout most of the reach between measurement site 1 (near Arco) and measurement site 13 (upstream from the Big Lost River Sinks). Loss from the river in the reach between measurement site 6 (INEL diversion) and measurement site 7 ranged from 1 to 4 cfs/mile. Loss in the reach between measurement site 13 and measurement site 14 ranged from 7 to 12 cfs/mile. Discharge measurements made May 6-8, 1985, when streamflow near Arco was 372 cfs, indicated that channel infiltration is largest at high stages. A maximum loss of 28 cfs/mile was measured in the are of the Big Lost River Sinks. Water levels in the area immediately southwest of the RWMC and the area between the NRF and playas 1 and 2 were substantially affected by recharge from the Big Lost River.

Data:

streamflow gage: location, discharges. Big Lost River discharge, infiltration, regional water table, well hydrograph

Bishop, C.W., 1991. Abbreviated Sampling and Analysis Plan -- Test Reactor Area Perched Water Zone Testing to Determine Aquifer Properties; EG&G Idaho, Inc., EGG-WM-9718, 13 pages.

Abstract or Summary:

Procedures are provided for hydraulic testing of the perched water zone at the Test Reactor Area of the Idaho National Engineering Laboratory. Tests to be used include the slug test for hydraulic conductivity, and a pumping test using an observation well to determine transmissivity and storativity.

Data:

borehole: location, completion. well: depth, location. perched water: TRA.
hydrologic testing. aquifer: depth.

Borghese, J.B., 1991. Hydraulic Characteristics of Soil Cover Subsurface Disposal Area Idaho National Engineering Laboratory; Department of Geology, University of Idaho.

Abstract or Summary:

The characteristics of 14 samples from the soil cover of the subsurface disposal area Idaho National Engineering Laboratory were examined. Laboratory methods were used to determine the following characteristics: saturated conductivity, grain size distribution, dry bulk density, and porosity. The range of saturated vertical hydraulic conductivity of the samples tested is $7.7\text{E-}6$ to $8.4\text{E-}2$ centimeters per second. The analysis of grain sizes indicates that the samples are predominantly silt size, dry bulk densities range from 1 to 1.5 grams per cubic centimeter. Laboratory porosity values range from 25% to 38%. The highest K values were determined to be 5 to 15 centimeters below land surface for 45% of the tested samples.

Data:

Saturated conductivity, grain size distribution, dry bulk density, porosity for surface soils.

Bowman, A.L., W.F. Downs, K.S. Moor, B.F. Russell, 1984. INEL Environmental Characterization Report Volume I: Summary; EG&G Idaho, Inc., EGG-NPR-6688.1, 250 pages.

Abstract or Summary:

This environmental characterization report contains general information on environmental aspects of the INEL, and specific information on two areas within the INEL which have been tentatively selected for NPR (New Production Reactor) siting. The objective of this report is to present environmental information, but not assess environmental impacts. The specific topics addressed in this report are as follows: geography, physiography, and demography of the INEL; ecology; climatology overview; geology and seismology; hydrology; cultural resources assessment; baseline socioeconomic data; description of INEL facilities; effluent and environmental measurements and monitoring programs; exposure pathways; and environmental laws and regulations. The hydrology section contains a general overview of the surface water that impacts the site (Big Lost River, Little Lost River, and Birch Creek), the regional aquifer, and water quality. Recharge to the aquifer is discussed qualitatively.

Data:

human population, air temperature, precipitation, wind speed, snowfall, dew point temperature, lithology, earthquakes, Big Lost River discharge, transmissivity, regional water table altitude. ecology: flora, fauna. water quality: silica, calcium, magnesium, potassium, bicarbonate, carbonate, sulfate, chloride, fluoride, nitrate, specific conductance, pH, temperature, turbidity, total solids, hardness, alkalinity, iron, manganese sodium, color. liquid waste: tritium, Ar-41, Ba-139, Cs-138, Kr-85m, Kr-87, Kr-88, Rb-88, Xe-133, Xe-135, Xe-135m, Xe-138, Ba-140, Ce-141, Ce-144, Co-60, Cr-51, Cs-137, I-131, Na-24, Nb-95, Ru-103, Sr-89, Sr-90, Zr-95, Cs-134, Mn-54, Ru-106, Sb-125, Am-241, Pu-238, Pu-239/240.

Bowman, A.L., W.F. Downs, K.S. Moor and B.F. Russell, 1984. INEL Environmental Characterization Report Volume II: Appendices A-B (Part A); EG&G Idaho, Inc., EGG-NPR-6688.2A, 416 pages.

Abstract or Summary:

Appendix A:The socioeconomic data base is a compilation of relevant socioeconomic data for that part of southeast Idaho which would be impacted by the proposed expansion of the Idaho National Engineering Laboratory (INEL) to accommodate the New Production Reactor (NPR). Two regions of impact have been specified. The consists of six Idaho counties: Bannock, Bingham, Bonneville, Butte, Jefferson, and Madison; this region includes the majority of the population and economic activity expected to be impacted by the NPR project. Detailed data on employment, income, housing, schools, etc. are reported for this region. A second region has been identified in accordance with the regulatory standards of the U.S. Nuclear Regulatory Commission (NRC). These standards require that human population, animal population, and land-use within 50 miles of the proposed reactor site be identified. An area covered by this 50-mi radius includes part or all of the counties listed above and also parts of Custer, Blaine, Lincoln, Minidoka, Power, Clark, Lemhi, and Fremont counties. This region is used in Section A2 (Population and Social Characteristics), and Section A10 (Agriculture) to report the distribution of human and animal populations and agricultural activities. Appendix B is an ecological characterization of the Idaho National Engineering Laboratory including a regional overview of terrestrial ecology, aquatic ecology, environmental characteristics of proposed NPR sites.

Data:

Appendix A: population, regional economy: income, housing, schools, health services, transportation services, labor force and employment, agriculture, water supply and deliver systems, irrigation water rights. **Appendix B:** Birds, small mammals, reptiles and insects, soil classification.

Bowman, A.L., W.F. Downs, K.S. Moor and B.F. Russell, 1984. INEL Environmental Characterization Report, Volume II, Appendices C-D (Part B); EG&G Idaho, Inc., EGG-NRP-6688.2B, 412 pages.

Abstract or Summary:

Appendix C is a site-specific climatology summary for the candidate sites for the NPR. Included is precipitation data for selected hourly and daily time periods and snowfall amounts and depths, snow occurrence. Appendix D: As part of the Idaho National Engineering Laboratory (INEL) Characterization, some special geologic studies were conducted. These studies are summarized in or included as Appendices D1 through D7. Appendix D1 contains data on the NPR Site E Borehole Completion. A test hole was drilled to provide subsurface geologic and hydrologic data specific to the location designated as NPR Site E. Geologic data to be obtained included stratigraphy, lithology, fracture characteristics, void spaces, age dates, and paleomagnetic orientation of basalts. Hydrogeologic data to be obtained included depth to groundwater and the possible presence of perched water tables. Further hydrologic data will be obtained through pump testing conducted by the USGS. Appendix D2 describes the investigation of the principal lineament at the INEL. The principal lineament, a feature visible in aerial photographs of the eastern Idaho National Engineering Laboratory, was investigated to determine whether or not the lineament was the surface expression of a fault. The investigations included: (a) a vegetation survey; (b) direct-current resistivity and time-domain electromagnetic resistivity geophysical surveys to explore for subsurface offsets; (c) trenching to look for near-surface offset; (d) soil stratigraphy; (e) outcrop mapping. These investigations allowed the construction of a geologic/geophysical cross-section that extended from the grass roots to a depth of approximately 2.5 km. There was no evidence that the principal lineament is associated with either near-surface or deep faulting. The lineament is a surface phenomenon posing no hazard to the nuclear facilities on the INEL. Appendix D3 contains a multidisciplinary investigation of the tectonic significance of a feature just north of Mud Lake, Idaho, known as Clay Butte. In the past, the southern and eastern edges of Clay Butte were identified as faults along which the butte had been uplifted. This study was performed to either prove or disprove the faulting theory, thus attempting to determine if the origin of the butte was tectonic. Mud Lake and Clay Butte are proximal to the INEL, and therefore any potential tectonic activity associated with the feature could have an effect on the eventual performance of the reactor. Appendix D4 contains data on fault studies of the INEL. An evaluation of potential seismic sources that may affect siting of major new facilities has been conducted for the INEL. The study focused on the evaluation of the Howe, Arco, and postulated Boundary faults that are located north and northwest of the INEL. The primary objectives of the study were (1) to address the possible extent of the Howe and Arco faults, south-eastward into the Eastern Snake River Plain, and (2) to assess the evidence for the existence of the postulated Boundary fault. Appendix D5 contains the data and discussion of the seismology of the INEL. The INEL is located approximately 50 mi southeast of the epicenter of the 1983 magnitude 7.3 Borah Peak, Idaho earthquake. Thirteen strong-motion accelerographs located at various facilities around the INEL Site recorded ground motion from the earthquake. The acceleration records were digitized and processed to obtain corrected acceleration, velocity, and displacement plots--along with response and Fourier spectra. The horizontal accelerations at the INEL were large

enough to trigger the automatic shutdown devices for reactors operating at the time of the earthquake. Appendix D6 contains information on the geologic map of the INEL and description of the map units used. Appendix D7 presents data on the possible volcanic hazards at the INEL. The study addresses potential volcanic sources that may affect the siting of major new facilities on the INEL. In particular, the study emphasized the evaluation of possible structural control of volcanism in the Eastern Snake River Plain and the description of potential volcanic processes that could occur in future eruptions near the INEL. The primary objective of the investigation focused on whether the location and distribution of volcanic sources (vents) may be controlled by geologic structure and whether this control may put constraints on the location of potential future eruptions.

Data:

Appendix C: air temperature, soil temperature, precipitation, snowfall, humidity, wind speed. Appendix D: borehole: log, completion geophysical log, lithology, stratigraphy. seismic activity: geology, faults, earthquakes. volcanic activity: vents, lava flows, rift zones.

Bowman, A.L., W.F. Downs, K.S. Moor, B.F. Russell, 1984. INEL Environmental Characterization Report Volume III: Appendix E,F,G,H; EG&G Idaho, Inc., EGG-NPR-6688.3, 450 pages.

Abstract or Summary:

Appendix E. The purpose of this appendix is to present summarized aquifer data for the purposes of characterizing the subsurface hydrology of the INEL site and vicinity. Also presented as supplement A is an assessment of probable Big Lost River flooding from a hypothetical failure of Mackay Dam, which is included as a separate abstract. The water level observation well program was designed to (a) determine the changes in gradient that influence the rate and direction of ground water and radionuclide movement, (b) identify sources of recharge to the aquifer, and (c) measure the extent of recharge effects. Levels were measured in regional and perched aquifers. A total of 3,841 water level measurements were made from 1974 to 1978. Location of water level observation wells and the frequency of water level measurements are presented in the report, as well as the water table relationships and the sources of recharge.

Appendix F. Part I of this report is a general overview of the paleontological, historic and prehistoric cultural resources known within the boundaries of the INEL and in its vicinity. This overview establishes the geographic, temporal, and cultural setting for predicting the resources which might be encountered in the study areas and the background against which the identity and significance of these resources might be judged. Part II presents the results of a ground survey initiated to locate cultural resource features and sites on two study areas at the INEL, recommendations for their conservation, evaluation and further study. Appendix H. Effluent measurements and environmental monitoring programs. Environmental monitoring at the Idaho National Engineering Laboratory may be roughly divided into effluent measurement and ambient environmental monitoring. Since most of the environmental impacts of INEL site operations are not measurable by ambient environmental monitoring, effluents are measured to (a) assure that releases are as low as reasonably achievable, (b) evaluate the relative importance of various effluents, (c) provide the source terms for calculating environmental impacts, and (d) assess any potential for buildup over periods of time. Environmental monitoring programs at INEL are conducted to determine (a) the overall impact of DOE operations on the environment, (b) whether environmental levels of pollutants comply with applicable standards, (c) whether containment and control systems at the facilities are functioning as planned, and (d) long-term trends of concentrations in the environment that any change is in those trends.

Data:

Appendix G is a description of INEL facilities. This description includes a Test Area North, the Naval Reactor Facility, Test Reactor Area, Idaho Chemical Processing Plant, Central Facilities Area, Power Burst Facility, Auxiliary Reactor Area, Argonne West, and the Radioactive Waste Management Complex. Appendix E: Water surface profiles, water quality, temperature, color, pH, specific conductance, Ca, Mg, Na, K, HCO₃, CO₃, SO₄, Cl, NO₃, F, SiO₂, Fe. Appendix F: There are no field data in this report other than some of the archeological items that were recovered at various sites. Appendix G: Hazardous waste. Appendix H: Airborne waste, radioactivity, Ar-41, Ba 139, 140, Cs 138, Ce 141 and 144, Co 60, Cr 51, Cs 137, H₃I 131, Na 124, Nb 95, Ru 103, Sb 124, Sr 89 and 90, and Zr 95, Kr 85, 87, 88, Rb 86, Xe 133, 135, 138, Ce 141, 144, Co 60, Cs 134, Cs 137, Mn 54, Ru 103, 106, Sb 125, Sr 90, Zr 95, Am 241, Pu 238, 239, and 240, surficial soil tritium.

Brooks, J.M., T.A. Matzen, M.J. Spry, S.M. Burns, K.M. Ludi, and S.N. Stanisich, 1990. Sampling and Analysis Plan for the Auxiliary Reactor Area-III Facility; EG&G Idaho, Inc., EGG-WM-9003, 172 pages.

Abstract or Summary:

This report outlines a sampling and analysis plan for assessing the extent of site contamination at the Auxiliary Reactor Area III. Based on the findings of the study, a decontamination and decommissioning plan for the site will be prepared. The document reviews site specific information about surface and subsurface geology, mineralogy, cation exchange capacity, Kd (sorption coefficient) and soils. It reviews site hydrology, and includes a list of sample handling techniques, radionuclide half lives, and detection limits. No new data are developed.

Data:

surficial sediment: mineralogy, montmorillonite, mica, kaolinite, quartz, calcite, feldspar, dolomite, cation exchange capacity, sorption coefficient. basalt: cation exchange capacity. transmissivity, storage coefficient, bore hole log. hazardous waste: acetone, methyl ethyl ketone, methylene chloride.

Burgus, W.H. and S.E. Maestas, 1976. The 1975 RWMC Core Drilling Program; U.S. Energy Research and Development Administration, IDO-10065, 36 pages.

Abstract or Summary:

Samples of materials taken from cores of three wells drilled in 1975 at the RWMC at INEL were radiochemically analyzed for the presence of radioactive waste nuclides. These nuclides are present in radioactive wastes placed in shallow pits and trenches near the ground surface. None of the results of the sample analysis were statistically positive indicating no detectable downward migration to and retention in either of two major sedimentary beds underlying the area at depths of about 110 and 240 feet. Extensive measures were taken to preclude extraneous radioactive contamination of core samples.

Data:

generalized lithology, gamma-gamma log, gamma-ray log, neutron log, core description, sedimentary interbed: radioactivity, Pu-238, Pu-239, Pu-240, Am-241, Sr-90, Ce-144, Cs-137, Co-60.

Burr, J.R., G.J. McManus, F.A. Hohorst, F.A. Duce, G.L. Peterson and S.J. Fernandez, 1983. Determination of Baseline Levels of Toxic Non-Radioactive Substances at the ICPP; Exxon Nuclear Idaho Company, Inc., ENICO-1136, 28 pages.

Abstract or Summary:

This report documents the concentrations of nonradioactive hazardous materials in off-gas, precipitation, and soil at the ICPP. Also, methods of collection and analysis were evaluated for boron, cadmium, fluoride, and mercury in ICPP off-gas and for mercury and cadmium in ICPP soil.

Data:

airborne waste: concentration, release rate, mercury, boron, cadmium, fluoride.
precipitation: concentration, mercury, cadmium. surface soil: concentration, mercury, cadmium

Carrigan, P.H. Jr., 1972. Probability of Exceeding Capacity of Flood-control System at the NRTS, Idaho; U.S. Geological Survey, IDO-22052, 102 pages.

Abstract or Summary:

The present flood-control at the NRTS consists of earth-fill embankments which partially dam flow in the Big Lost River, near the southwest corner of the station, and which confine the flow diverted at the dam to four spreading grounds. Water passing through the dam flows northeastwardly in the river to accumulate in four dry lakes (terminus of the river). Water diverted into the spreading grounds may spill onto unimproved private lands. Analyses of historical streamflow information indicate that floods in the Big Lost River would overtop the flood-control diversion dam about once every 55 years on the average; if the culverts in the dam are completely plugged, overtopping of the dam would occur about once every 16 years. Effects of synthetically generated snowmelt floods on the flood-control system have been analyzed. These analyses indicate that the diversion dam will not be overtopped by a 300-year flood if the capacity of the diversion to the spreading grounds is doubled. The analyses also suggest that doubling the capacities of channels connecting spreading grounds would be prudent.

Data:

snowmelt, Big Lost River discharge, flood frequency, stage-discharge relations, flood routing, seepage, evaporation.

Cassidy, G.B., 1982. Radioactive Waste Management Information 1981 Summary and Record-To- Date; U.S. Department of Energy, IDO-10054(81), 58 pages.

Abstract or Summary:

This document summarizes radioactive waste data records for the INEL compiled since 1952. Kinds of information include volume, radioactivity, isotopic identity, origin, and decay status. The radioactive waste data presented was obtained from the INEL Waste Management Information System (WMIS). This report is updated annually to incorporate waste management data for the current year and reflects changes in previous annual reports. Changes are made to more accurately reflect the current status of waste operations at the INEL.

Data:

liquid waste: volume, radioactivity, source, Ag-110, Ag-110M, Ba-140, C-14, Ce-141, Ce-143, Ce-144, Co-57, Co-58, Co-60, Cr-51, Cs-134, Cs-137, Fe- 59, tritium, Hf-181, I-129, I-131, I-132, I-133, La-140, Mn-54, Mo-99, Na-24, Nb-95, Np-239, Pu-238, Pu-239, Pu-240, Ru-103, Ru-106, Sb-124, Sb-125, Sc-46, Sr-89, Sr-90, Sr-91, Ta-182, Tc-99M, Te-132, U-234, U-235, U-238, Y-91M, Zn- 65, Zr-95, Zr-97. Airborne waste: volume, radioactivity, source, Ag-110M, Ar-41, Ba-140, La-140, Ba-131, Ba-139, Ba-140, Be-7, Br-82, C-14, Ce-141, Ce-144, Co-57, Co-58, Co-60, Cr-51, Cs-134, Cs-137, Cs-138, Eu-152, Eu-154, Eu-155, Fe-59, tritium, Hf-181, I-129, I-131, I-132, I-133, I-134, I-135, Kr-85, Kr-85M, Kr-87, Kr-88, Mn-54, Mo-99, Nb-95, Pu-238, Pu-239, Pu-240, Rb-88, Ru-103, Ru-106, Sb-122, Sb-125, Sn-113, Sr-90, Ta-182, To-99M, Te-132, Xe-133, Xe-135, Xe-135M, Xe-138, Zr-95. solid waste: volume, radioactivity, source, container, storage location, Am-241, Ba-133, Ba-140, Cd-109, Ce-141, Ce-144, Co-57, Co-58, Co-60, Cr-51, Cs-134, Cs-137, Eu-152, Eu-154, Eu-155, Fe-59, tritium, Hf-181, I-125, La-140, MAP, MFP, Mn-54, Na-22, Nb-95, Np-237, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Ra-226, Ru-103, Ru-106, Sb-125, Sr-90, To-99, Th-228, Th-232, U-233, U-234, U-235, U-236, U-238, Zn-65, Zr-95.

Copeland, D.F., and M.J. Spry, 1991. Closure Plan for the Test Area North Sulfuric Acid Spill Area (COCA Unit LOFT-10); EG&G Idaho, Inc., EGG-WM-9255, 57 pages.

Abstract or Summary:

This document describes the proposed plans for closure of the Test Area North (TAN) Sulfuric Acid Spill Area (COCA Unit LOFT-10) at the Idaho National Engineering Laboratory in accordance with the Resource Conservation and Recovery Act (RCRA) Interim Status Closure Guidelines. The location and physical characteristics of the site are described, and the results of previous contaminant sampling and analysis are discussed. Options for closure are defined, and the selected option for closure is described in detail. Pending analytical results of soil sampling, it is anticipated that the site will be clean closed in its present condition. If sampling indicates contamination, clean closure activities will include possible excavation, removal, and offsite transportation and disposal of contaminated soil as determined by sampling. A cost estimate and a tentative schedule for closure activities are also presented.

Data:

surficial sediments: thickness, altitude, pH, well: location, hydrology, ground water discharge, recharge: irrigation seepage, Aquifer: depth, thickness, storativity, transmissivity.

Davis, L.C. and J.R. Pittman, 1990. Hydrological, Meteorological, and Geohydrological Data for an Unsaturated Zone Study near the Radioactive Waste Management Complex, Idaho National Engineering Laboratory, Idaho--1987; U.S. Geological Survey, IDO-22086, 208 pages.

Abstract or Summary:

During 1987, data were collected from the test trench area, where several types of instrumentation were installed in the surficial sediment in 1985. Hydrological data collected from both disturbed and undisturbed soil included measurements, recorded hourly and averaged every 12 hours, of soil temperature and capillary pressure from 28 thermocouple psychrometers placed at selected depth to about 6 m. Soil moisture content measurements were collected biweekly in nine neutron probe access holes with a neutron moisture depth gage. One additional neutron probe access hole was installed during November 1987. Meteorological data collected hourly and summarized daily included incoming and emitted long wave radiation; incoming and reflected short wave radiation, air temperature, relative humidity, and wind speed at 1 and 2 m above land surface; wind direction; and precipitation. To describe grain size distribution with depth, nine samples from neutron probe access hole 1, and eight samples from the east lysimeter area were analyzed. Additionally, generalized carbonate content, color, particle roundness and sphericity, and mineralogic and clastic constituents were determined for each sample. Selected size fractions of some samples were analyzed for bulk and clay mineralogy.

Data:

test trench instrumentation, soil temperature, soil moisture profile, grain size distribution profile, capillary pressure, incoming long wave radiation, reflected long wave radiation, incoming short wave radiation, reflected short wave radiation, air temperature, relative humidity, wind speed, wind direction, precipitation, bulk mineralogy: color, roundness, sphericity, quartz, plagioclase, calcite, dolomite, smectite, chert, illite, kaolinite, chlorite, orthoclase

Del Debbio, J.A. and T.R. Thomas, 1989. Transport Properties of Radionuclides and Hazardous Chemical Species in Soils at the Idaho Chemical Processing Plant; Westinghouse Idaho Nuclear Company, Inc., WINCO-1068, 48 pages.

Abstract or Summary:

Laboratory studies have been completed to provide measured transport parameters for selected hazardous chemical species to allow for development of accurate solute transport models. Retardation factors and dispersion coefficients for Tc-99 (technetium) (as pertechnetate ion) and Se-79 (selenium) (as selenate ion) were measured in water-saturated soil columns of surficial and interbed sediments and crushed basalt. A retardation factor was also determined for selenite ion in basalt. The data indicate no retardation of pertechnetate and selenate in all the materials studied and slight retardation of selenite in basalt. Retardation factors for selenite in surficial and interbed sediment were calculated from batch sorption data and were estimated to be in the range of 13-230. Distribution coefficients for cadmium, mercury, selenium (as selenite) and strontium were measured using batch equilibrium sorption methods. Measured distribution coefficients for sorption of cadmium and strontium on sedimentary materials were very nearly independent of initial metal concentrations in contrast to mercury and selenium whose distribution coefficient values were highly dependent on initial metal concentrations.

Data:

surficial sediment: calcium carbonate, calcium, magnesium, iron, specific gravity, grain size distribution, texture, x-ray diffraction analysis, retardation factor, dispersion coefficient, distribution coefficient. sedimentary interbed: calcium carbonate, calcium, magnesium, iron, specific gravity, grain size distribution, texture, x-ray diffraction analysis, retardation factor, dispersion coefficient, distribution coefficient. basalt: calcium carbonate, calcium, magnesium, iron, specific gravity, x-ray diffraction analysis, retardation factor, dispersion coefficient, distribution coefficient. water quality: calcium, magnesium, silica, total iron, sodium, potassium, chloride, sulfate, bicarbonate, oxygen, pH, redox potential. leaching column study, solute breakthrough curves. retardation factor: cadmium (Cd), mercury (Hg), selenium (Se), strontium (Sr). dispersion coefficient: cadmium (Cd), mercury (Hg), selenium (Se), strontium (Sr). distribution coefficient: cadmium (Cd), mercury (Hg), selenium (Se), strontium (Sr).

Deutsch, M., R.L. Nace and E. Shuter, 1954. Geology and Groundwater Resources of a Part of Western Jefferson County Adjacent to the NRTS, Idaho; U.S. Geological Survey, IDO-22028-USGS.

Abstract or Summary:

This report is a quantitative evaluation of the potential perennial supply of groundwater that is available in an area adjacent to the northeastern part of the NRTS, south of the Mud Lake Basin, Idaho. Included also are data on the chemical quality of the groundwater that is present in the area and a discussion of the direction of groundwater flow. The natural groundwater reservoir of the Snake River Plain is the sole perennially dependable source of water supply for facilities on the NRTS.

Data:

water quality: temperature, specific conductance, silica, iron, manganese, calcium, magnesium, sodium, potassium, bicarbonate, carbonate, sulfate, chloride, fluoride, nitrate, boron, dissolved solids, hardness, pH, color, turbidity. well: use, depth, casing, water level, altitude. snake river basalt, Terreton Lake sediments, playa sediments.

Deutsch, M., R.L. Nace and P.T. Voegell, 1952. Geology, Ground Water, and Waste-Disposal at the Aircraft Nuclear Propulsion Project Site, National Reactor Testing Station, Idaho; U.S. Geological Survey, IDO-22023-USGS, 45 pages.

Abstract or Summary:

Summary of the principal results of a detailed ground water and geologic study of the proposed Aircraft Nuclear Propulsion (ANP) Project Site. Emphasis in the report is on important geologic factors that are related to safety, layout, construction, operation, and maintenance: on the availability of a water supply; and on problems in the routine disposal and unintended loss of radioactive waste. Geologic details, the source and occurrence of ground water, the directions of ground-water movement, and the hydraulic properties of water-bearing materials are considered in relation to the special nature of the ANP facility. Considerable discussion is devoted to evaluation of radioactive and nonradioactive waste disposal. A combination of infiltration ponds, seepage ditch and disposal well are the recommended method for liquid waste disposal. Highly radioactive waste would be stored on-site until a disposal mechanism was found.

Data:

grain size distribution, regional water table, condensed drillers logs, near surface stratigraphy, fence diagram.

Deutsch, M., P.T. Voegell, R.L. Nace and J.R. Jones, 1952. Geology and Ground Water in the Northeastern Part of the National Reactor Testing Station, Idaho; U.S. Geological Survey, IDO-22022-USGS, 61 pages.

Abstract or Summary:

Summary of the principal results of a detailed study of the ground water and geology of the Northeastern Part of the NRTS. The investigations emphasize evaluation, development, conservation, and protection of ground water resources. The geologic information gathered is useful in engineering planning and design, well construction, liquid waste disposal, drainage, road construction, and excavation. Emphasis is on the rocks, soils and sediments present at the land surface, their types, surficial distribution, and probable subsurface extensions.

Data:

grain size distribution, perched water, discharge-drawdown, condensed and modified drillers logs. water quality: temperature, pH, specific conductance, color, turbidity, silica, iron, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, fluoride, nitrate, boron, manganese, hydroxide, total dissolved solids, hardness.

Doornbos, M.H., 1990. Abbreviated Sampling and Analysis plan for the TRA drilling and sampling Waste Characterization; EG&G Idaho, Inc., EGG-WM-9113, 19 pages.

Abstract or Summary:

The objective of this project is to provide technically representative sampling and analysis data on the excess drilling and sampling material generated during all environmental investigations at TRA. For FY-1990 the sites include the TRA warm waste pond, the TRA chemical waste pond and the TRA paint shop ditch. This information will be used to determine when the material is classified as RCRA hazardous and hence determine the final disposition of the material. RCRA hazardous classification will be based on the toxicity characteristics leaching procedure (TCLP Federal Register Volume 55, Number 61, March 29, 1990) and the RCRA characteristic tests ignitability reactivity and corrosivity according to data quality objectives for remedial response activities (OSWER 9355.0-7B). The appropriate quality level for these tests is analytical level three.

Data:

There are no data in this report.

Druffel, L., G.J. Stiltner, and T.N. Keefer, 1979. Probable Hydrologic Effects of a Hypothetical Failure of Mackay Dam on the Big Lost River Valley from Mackay, Idaho, to the INEL; U.S. Geological Survey, IDO-22058, 47 pages.

Abstract or Summary:

Mackay Dam is an irrigation reservoir on the Big Lost River, Idaho, approximately 7.2 kilometers northwest of Mackay, Idaho. Consequences of possible rupture of the dam have long concerned the residents of the river valley. The presence of reactors and of a management complex for nuclear wastes on the reservation of the INEL, near the river, give additional cause for concern over the consequences of a rupture of the dam. The objective of this report is to calculate and route the flood wave resulting from the hypothetical failure of Mackay Dam downstream to the INEL. Both a full and a 50% partial breach of this dam are investigated. Two techniques are used to develop the dam-break model. The method of characteristics is used to propagate the shock wave after the dam fails. The linear implicit finite-difference solution is used to route the flood wave after the shock wave has dissipated. The time of travel of the flood wave, duration of flooding, and magnitude of the flood were determined for eight selected sites from Mackay Dam through the INEL diversion. At 4.2 kilometers above the INEL diversion, peak discharges of 53,000 and 44,990 cfs and peak flood elevations of 9.2 and 8.9 feet were calculated for the full and partial breach, respectively. Flood discharges and peaks were not compared for the area downstream of the diversion because of the lack of detailed flood plain geometry. The effects of infiltration were also tested, and the results are presented as a comparison.

Data:

Big Lost River cross sections, dam break, flood peaks, flood discharge, infiltration

EG&G Idaho, Inc., 1991. Informal Report -- Closure Plan for the TSF Paint Shop Floor Drain Leach Field (COCA Unit TSF-27); EG&G Idaho, Inc., EGG-WM-9367, 82 pages.

Abstract or Summary:

This document describes the proposed plans for closure of the Technical Support Facility (TSF) Paint Shop Floor Drain Leach Field within Test Area North (TAN) in accordance with the Resource Conservation and Recovery Act (RCRA) Interim Status Closure Guidelines. The location and physical characteristics of the site are described, and the results of contaminant sampling are discussed. Options for closure are defined and the selected option is described in detail. The preferred closure method for the TSF Paint Shop Floor Drain Leach Field is clean closure by waste removal. The selected closure methodology may require modification following the completion of additional site sampling and analysis as described in the TSF-27 Sampling and Analysis Plan (EGG-WM-9101). Estimated costs and a tentative schedule for closure activities are also presented.

Data:

aquifer: depth, thickness. ecology: flora, fauna. transmissivity, storativity, liquid waste: source, concentration, Stoddard solvent, antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, thallium, phthalate, methylene chloride, toluene, acetone. aquifer recharge. regional water table, small mammals, vegetation, grain size distribution, surficial sediments: thickness. fence diagram, sedimentary interbed: thickness, altitude. basalt: thickness, altitude. well: depth, location.

EG&G Idaho, Inc., 1991. Inorganic TRA Warm Waste Pond Data 1988 Sampling Effort; EG&G Idaho, Inc., RDG-15-91, 47 pages.

Abstract or Summary:

This report summarizes the results of a review of analytical data for metals, total organic carbon (TOC), sulfide, and cyanide in soil samples taken from the Test Reactor Area Warm Waste Pond. The sampling effort is described in the Site Sampling and Quality Assurance Procedures for Test Reactor Area Warm Waste Pond (Envirodyne, 1988). This quality assurance report is provided at the request of EG&G Idaho, in support of their Environmental Restoration Program Sample Management Office (SMO). All laboratory analyses were performed by Envirodyne Engineers of St. Louis, Missouri. The sample group contained 17 samples. The analyses requested included arsenic, beryllium, cadmium, chromium, copper, lead, mercury, silver, zinc, cyanide, sulfide, and TOC. Not all samples were analyzed for all analytes.

Data:

sediment: arsenic, beryllium, cadmium, chromium, copper, lead, mercury, silver, zinc, cyanide, sulfide, and TOC

EG&G Idaho, Inc., 1991. Validation of Radiological Data From TRA Warm Waste Leaching Pond; EG&G Idaho, Inc., 9 pages.

Abstract or Summary:

Seventy-six soil and four water samples were taken from in and around the Test Reactor Area (TRA) Warm Waste Ponds at the Idaho National Engineering Laboratory (INEL). These samples were analyzed for radiochemical constituents at the EG&G Idaho, Radiation Measurements Laboratory (RML). The RML Internal Technical Report, ST-CS-039-88, and other supporting documentation have been reviewed by the Environmental Restoration Program/Sample Management Office (ERP/SMO) for the purpose of validating the sample results data. This report presents interpretation of the data, the quality levels achieved by the reported sample results, conclusions that can be drawn from the data, and sample results tables.

Data:

surficial sediments: radiological, Cs-134, Cs-137, Co-60, Cr-51, K-40, Mn-54, Co-58, Zn-65, Zr-95, Sb-125, I-131, Ba-140, Hg-203, U-238, U-234, U-232, U-235, Th-232, Th-230, Th-228, Pu-239, Pu-238, tritium.

EG&G Idaho, Inc., 1991. Validation of Inorganic Data from TRA Warm Waste Pond 1988 Sampling Effort; EG&G Idaho, Inc., RDG-16-91, 26 pages.

Abstract or Summary:

This report contains the validation data for the inorganic analyses for several soil samples. These soil samples were taken at the TRA warm waste leaching pond area in 1988. The analyses were done by PTI Environmental Services of Bellevue, Washington.

Data:

sediment: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc, cyanide.

EG&G Idaho, Inc., 1991. Validation of Semi-Volatile Organic Data from the 1988 TRA Warm Waste Pond Project; EG&G Idaho, Inc., RDG-07-91, 96 pages.

Abstract or Summary:

Several soil samples were taken from in and around the Test Reactor Area (TRA) Warm Waste Ponds at the Idaho National Engineering Laboratory (INEL). These samples were analyzed for semi-volatile organics by the USEPA CLP method. The results of the validation process is presented and the reason for the qualification. Copies of the validated data, a glossary defining the data validation flags, and a list of samples contained in the data package are attached at the end of this document.

Data:

sediment: pentachlorophenol, bis(2-ethylhexy)phthalate, di-n-butylphthalate, di-n-octylphthalate

EG&G Idaho, Inc., 1991. Validation of Volatile Organic Data from the 1988 TRA Warm Waste Pond Project-SDG-TRA0388001; EG&G Idaho, Inc., RDG-09-91, 59 pages.

Abstract or Summary:

This report contains the validation of volatile organic data from the 1988 TRA warm waste pond project. The samples were analyzed for volatile organics by the USEPA method 8240. The samples were tested for the compounds acetone and acrylonitrile. The results of these tests were provided with the validation process used.

Data:

surficial sediment: acetone, acrylonitrile

Garabedian, S.P., 1986. Application of a Parameter-Estimation Technique to Modeling the Regional Aquifer Underlying the Eastern Snake River Plain, Idaho, U.S. Geological Survey Paper 2278; U.S. Geological Survey, 60 pages.

Abstract or Summary:

A nonlinear, least-squares regression technique for the estimation of ground-water flow model parameters was applied to the regional aquifer underlying the eastern Snake River Plain, Idaho. The technique uses a computer program to simulate two-dimensional, steady-state ground-water flow. Hydrologic data for the 1980 water year were used to calculate recharge rates, boundary fluxes, and spring discharges. Ground-water use was estimated from irrigated land maps and crop consumptive-use figures. These estimates of ground-water withdrawal, recharge rates, and boundary flux, along with leakance, were used as known values in the model calibration of transmissivity. Leakance values were adjusted between regression solutions by comparing model-calculated spring discharge to measured spring discharges. In other simulations, recharge and leakance also were calibrated as prior-information regression parameters, which limits the variation of these parameters using a normalized standard error of estimate.

Data:

stratigraphy: generalized. seismic activity: faults, rift zones. sedimentary interbeds, basalts. transmissivity, storage coefficient. recharge: Snake River, irrigation seepage, precipitation. discharge: seeps, springs. water budget modeling: regression, steady-state, 2-dimensional, finite-difference, calibration.

Garabedian, S.P., 1989. Hydrology and Digital Simulation of the Regional Aquifer System, Eastern Snake River Plain, Idaho Open-File Report 87-237; U.S. Geological Survey, 151 pages.

Abstract or Summary:

The occurrence and movement of water in the Snake River Plain aquifer depends on the transmissivity and storage capacity of rocks that compose the geologic framework and the distribution and amount of recharge and discharge of water within that framework. On a regional scale, most water moves horizontally through interflow zones in the basalt of the Snake River Plain. In recharge and discharge areas, water also moves vertically along joints and interfingering edges of basalt flows. Along the margins of the plain, sand and gravel several hundred feet thick transmit large volumes of water. This report primarily discusses the groundwater flow for the entire Snake River Plain aquifer. Not much attention is paid specifically to the INEL site and its related drainages. Regional groundwater flow is generally from northeast to southwest, from areas of recharge to areas of discharge. The flow was simulated with numerical groundwater models. Initially, a two-dimensional steady-state model included a nonlinear, least-squares regression technique that was used to estimate aquifer properties. Later, a three-dimensional steady-state and transient model was used to replace the two-dimensional model. Model results indicated that average transmissivity ranged from about 0.5 to 120 sq ft/sec and vertical leakance from about $3\text{E-}10$ to $5\text{E-}6$ ft/sec/ft of aquifer thickness. The transient model was used to simulate aquifer changes from 1980 to 2010 in response to three hypothetical development alternatives (1) Continuation of 1980 hydrologic conditions, (2) increased pumpage, and (3) increased recharge. Under condition (1), the simulation indicated head declines of 2 to 8 feet; for condition (2), with an additional 2,400 ft³/sec of pumpage, a decline of 10 to 50 feet was predicted; simulation for condition (3), with increase recharge of 800 cfs, was a rise in head of 0 to 5 feet.

Data:

precipitation, consumptive use, transmissivity, storativity, irrigation, recharge, groundwater discharge, groundwater levels, well hydrographs, groundwater model, hydraulic conductivity.

Ginkel, W.L., C.W. Bills, A.O. Dodd, K.K. Kennedy, and F.H. Tingey, 1960. Nuclear Incident at the Idaho Chemical Processing Plant on October 16, 1959.; U.S. Atomic Energy Commission, Idaho Operations Office, IDO-10035, 100 pages.

Abstract or Summary:

At approximately 0250 Friday, October 16, 1959 a nuclear incident occurred in a process equipment waste collection tank at the Idaho Chemical Processing Plant, National Reactor Testing Station. Radiation alarms in the plant were set off by the resulting release of air-borne radioactivity, and 21 shift workers and security personnel on duty evacuated the process building and the surrounding area of high radioactivity. No medical treatment was required. Additional checks have disclosed no neutron exposure nor significant internal dose from inhalation. The waste collection tanks are approximately 50 feet below grade with a 4-foot thick concrete deck over the vessels. This effectively prevented the escape of fission neutrons or gamma radiation from the reaction into operating areas.

Data:

air quality: radioactivity. airborne waste: radioactivity. Wind: direction, speed.

Golder Associates Inc., 1990. Final Well Completion Report for Wells 121, 122, and 123 at the Idaho Chemical Processing Plant; Golder Associates Inc., Redmond/Richland, Washington, 95 pages.

Abstract or Summary:

**Describes the installation of three wells suitable as RCRA monitoring wells.
Discusses the drilling, logging, and completion of the three wells.**

Data:

borehole log, gamma-ray log, gamma-gamma log, neutron log.

Golder Associates, Inc., 1991. Report for the Idaho Chemical Processing Plant Drilling and Sampling Program at Land Disposal Unit CPP-59; Golder Associates, Inc., Richland, Washington, Golder 893-1195.320, 27 pages.

Abstract or Summary:

Eleven boreholes were drilled and sampled for chemical analysis at LDU CPP-59. Nine of the boreholes were drilled and sampled to a depth of six feet and two were drilled and sampled to the top of the basalt at a total depth ranging from 40 to 43.5 feet. Samples were analyzed for volatile organic compounds and total petroleum hydrocarbons. The results of the sampling analysis show that total petroleum hydrocarbons indicative of the spilled kerosene were detected at the site. The volatile components of kerosene of primary toxicological concern, benzene, toluene and ethylbenzene were not detected. The only volatile compound detected, xylene, was not detected at sufficient concentrations to pose a health risk. In conclusion, LDU CPP-59 has been the site of reported kerosene spills but because kerosene is not a RCRA hazardous waste, further RCRA closing activities are not recommended for the site. Though xylene was detected at LDU CPP-59, it was not detected at concentrations that would designate the soils as a hazardous waste. Petroleum hydrocarbons were detected in the soils at the 38 to 43.5 foot depths where possible perched ground water conditions exist. Recommendations for further work include evaluation of results of existing ground water monitoring data from existing wells and the installation of shallow wells to the surface of the basalt at CPP-59 to determine concentration of kerosene-related contaminants in shallow perched ground water.

Data:

Borehole logs, surficial sediments, ethylbenzene, xylene, methylene chloride, hexane, carbon tetrachloride, ethylbenzene, chloroform, chlorobenzene, tetrachloroethane, acetone, toluene.

Golder Associates Inc., 1991. Geohydraulic and Petrographic Analyses of Samples from Well 121 and 123; Golder Associates Inc., Redmond/Richland, Washington, Golder 893-1195.002, 70 pages.

Abstract or Summary:

This report describes the testing methods and presents the results of geohydraulic and petrographic analyses of nine samples, selected from soil and rock core collected while drilling monitoring wells 121 and 123.

Data:

basalt: moisture content, bulk density, specific gravity, hydraulic conductivity, porosity, petrology. sedimentary interbed: moisture content, bulk density, hydraulic conductivity, specific gravity, porosity, grain size distribution, cation exchange capacity, x-ray diffraction. surficial sediment: moisture content, bulk density, hydraulic conductivity, specific gravity, porosity, grain size distribution, cation exchange capacity, x-ray diffraction.

Golder Associates, Inc., 1991. Report for the Idaho Chemical Processing Plant Drilling and Sampling Program at Land Disposal Units CPP-39; Golder Associates, Inc., Redmond/Richland, Washington, Golder 893-1195.310, 100 pages.

Abstract or Summary:

The objective of the environmental investigation at land disposal unit (LDU CPP-39) were to determine the nature and extent of any hazardous constituents released to a containment vault and dry well as a result of hydrofluoric acid storage and disposal. This information is needed to determine RCRA closure requirements. This work was performed in accordance with "The Technical Work Plan for the Idaho Chemical Processing Plant. Drilling and Sampling Program at Land Disposal Units CPP-39, CPP-59 and CPP-64 and solid Waste Management Units CPP-51 and CPP-54" (Golder Associates, 1990-A). No RECRA hazardous waste was identified during sampling and analysis at LDU CPP-39. The hazardous constituents detected (PAH) and (BEHP) cannot be attributed to disposal of listed hazardous wastes at LDU CPP-39. As a result, no decontamination or removal activity should be necessary to comply with RCRA closure requirements. A closure plan for this facility should describe the investigation performed to date and any additional sampling and analysis noted above.

Data:

Driller's log, sedimentary interbeds and specific chemicals, arsenic, barium, bis (2-ethylhexyl) phthalate, anthracene, benzoanthracene, benzopyrene, benzofluoranthene, benzoperylene, benzofluoranthene, chrysene, fluoranthene, indeno (1, 2, 3-cd) pyrene, mercury, phenanthrene, pyrene, fluoride.

Goldstein, F.J. and W.D. Weight, 1982. Subsurface Information from Eight Wells Drilled at the Idaho National Engineering Laboratory, Southeastern Idaho; U.S. Geological Survey, IDO-22063, 29 pages.

Abstract or Summary:

Six wells were drilled and two existing wells were deepened at the INEL from 1969 through 1974. Interpretation of data from the drilling program confirms that the subsurface is dominated by basalt flows interbedded with layers of sediment, cinders, and silicic volcanic rocks. Water levels in the wells show cyclic seasonal fluctuations of maximum water levels in winter and minimum water levels in mid-summer. Water levels in three wells near the Big Lost River respond to changes in recharge to the Snake River Plain aquifer from the Big Lost River. Measured water levels in multiple piezometers in one well indicate increasing pressure heads with depth. A marked decline in water levels in the well since 1977 is attributed to lack of recharge to the Snake River Plain Aquifer.

Data:

generalized lithology, caliper log, gamma-ray log, gamma-gamma log, neutron log, well hydrograph.

Goode, D.J. and L.F. Konikow, 1990. Apparent Dispersion in Transient Ground Water Flow; U.S. Geological Survey, in Water Resources Research Volume 26, Number 10, 12 pages.

Abstract or Summary:

This paper investigates the effects of a large-scale temporal velocity fluctuation, particularly changes in the direction of flow on solute spreading in the two-dimensional aquifer. Relations for apparent longitudinal and transverse dispersivity are developed through an analytic solution for dispersion in a fluctuating, quasi-steady, uniform flow field in which storativity is zero. For transient flow, spatial moments are evaluated from numerical solutions. Ignored or unknown transients in the direction of flow primarily act to increase the apparent transverse dispersivity because the longitudinal dispersivity is acting in a direction that is not the assumed flow direction. This increase is a function of the angle between the transient flow vector and the assumed steady-state flow direction, and of the ratio of transverse to longitudinal dispersivity. The maximum effect on transverse dispersivity occurs if storativity is assumed to be zero such that the flow field responds instantly to boundary condition changes.

Data:

No data are presented.

Goode, D.J. and L.F. Konikow, 1990. Re-Evaluation of Large Scale Dispersivities for a Waste Chloride Plume: Modeling of Transient Flows; Idaho Geological Survey Publication #IAHS-195, 10 pages.

Abstract or Summary:

This paper investigates the effects of transient ground water flow on dispersion of a waste chloride plume in the basaltic aquifer beneath the Idaho National Engineering Laboratory. In an early application of numerical modeling techniques to the two-dimensional simulation of field-scale plumes, previous investigators identified longitudinal and transverse dispersivities using an independently calibrated, steady-state flow model and matching contours of observed and simulated concentrations. The unusual result of calibrated transverse dispersivity (140 meters) being significantly larger than longitudinal dispersivity (90 meters) has been attributed to spatial heterogeneity, the fractured nature of the aquifer and the use of a two-dimensional model. New calibrations of the solute transport model are performed on point concentration observations using a flow model incorporating transient recharge conditions that cause significant fluctuations in velocity. Under transient flow conditions lowest calibration errors are achieved with significantly larger dispersivities than previously hypothesized and with the longitudinal component larger than the transverse component. Unfortunately, the sensitivity of the model calibration error to dispersivity is low. Incorporating transient flow to this two-dimensional porous media model does not significantly improve our understanding of the processes controlling chloride transport at this site.

Data:

Ground water quality, chloride

Hawkins, D.B. and D.C. Foster, 1963. A Comparison of Two Methods of Sampling Gravel for the Evaluation of a Ground-Disposal Site for Radioactive Liquid Waste; U.S. Atomic Energy Commission, Idaho Operations Office, ID-12027, 14 pages.

Abstract or Summary:

Two methods (auger holes and channels) were compared for grain size distribution in pits at the Materials Testing Reactor (MTR). It was found that the auger hole method under estimated the percentage of sand in the sample. A regression equation was developed to relate the results of the auger hole method to the more accurate results of the channel method.

Data:

grain size distribution. surficial sediments: thickness.

Hawkins, D.B., and B.L. Schmalz, 1965. Environmental Tritium Studies at the National Reactor Testing Station; U.S. Atomic Energy Commission, Idaho Operations Office, IDO-12043, 38 pages.

Abstract or Summary:

Past investigations of the hydrology of the National Reactor Testing Station (NRTS) concentrated principally on detailed investigations of small areas within the station. While such studies will continue future investigations will emphasize the large-scale view and will extend the present detailed knowledge of the small areas to the entire side. The efforts of this year's work was to determine the effect of underground disposal of liquid radioactive waste upon the regional ground water source. This required a knowledge of the travel path, velocity and volume of lost water, the nature and volume of the waste and the extent to which ion exchange, decay and dispersion reduce any hazard from the waste. Tritium artificially induced into the ground water has been used to determine the direction of velocity of the ground water flow and the amount of dispersion or dilution that takes place. Naturally occurring tritium by its known rate of decay has been used to determine the age of ground water. Rates of ground water movement based on "first arrival" ranged from 19 to 140 feet per day and averaged 60 feet per day. However, analysis of the tracer by center of mass, or maximum tritium concentration, indicate average ground water velocity is 10 to 13 feet per day. Tritium from waste disposal is traveling laterally beneath the NRTS and is discernable in water from several supply wells notably that at Central Facilities. A serious problem in the interpretation of tritium data is the extreme inconsistency of results of tritium analysis made by different laboratories. The MTR-ETR pond was constructed for the purpose of disposing of radioactive liquid waste by permitting the water to infiltrate into the ground. This procedure supposes that the waste eventually will reach the regional ground water resource. A continuing study of the hydrology of the pond system is being conducted to determine whether a potential hazard exists in this disposal method and to suggest a means of evaluating disposal systems to forestall the likelihood of any hazard developing. From the upper perched ground water body, the waste percolates downward until it reaches perching layers in the basalt from where it spreads laterally for substantial distances before moving slowly downward toward the regional water table. These perching layers are regarded as being beneficial as they delay the downward movement and provide for dispersion, dilution, attenuation and in time for radioactive decay. Recharge to the Snake Plain Aquifer by underflow from tributary areas is by far the most significant sources of ground water replenishment. The principal source of this recharge is from the Little Lost River and Birch Creek Valley and the Mud Lake Basin. The U.S. Geological Survey is conducting a sitewide program of water level measurement in selected wells to define regional trends and, to observe any water level changes that may result from operations at NRTS. Other U.S. Geological Survey offices are conducting studies that are supplementary to the hydrologic studies at the NRTS.

Data:

Precipitation tritium concentration, water quality tritium.

Hawkins, D.B. and H.L. Short, 1965. Equations for the Sorption of Cesium and Strontium on Soil and Clinoptilolite; U.S. Atomic Energy Commission, Idaho Operations Office, IDO-12046, 33 pages.

Abstract or Summary:

A useful quantity in studying the sorption of radionuclides on soils is the distribution coefficient. The distribution coefficient is an experimentally determined quantity and is dependent upon the conditions under which it is determined. Four equations have been developed which permit the calculation of the distribution coefficient for the sorption of cesium and strontium on soil and clinoptilolite. These equations hold over the following concentration ranges of the solution phase: calcium 5 to 500 ppm, magnesium 1 to 125 ppm, cesium 0.05 to 5 ppm, phosphate 0.1 to 10 ppm, and pH 4 to 9. The equation for the sorption of cesium on soil appears applicable to areas other than NRTS, where illitic soils predominate. The equation for the sorption of strontium on soil may be applicable to soils at other sites in which the sesquioxides are not abundant.

Data:

grain size distribution, distribution coefficient, saturation capacity, cation exchange capacity, cesium, strontium, calcium, magnesium, phosphate

Hoff, D.L., R.G. Mitchell, G.C. Bowman, and R. Moore, 1990. The Idaho National Engineering Laboratory Site Environmental Report for Calendar Year 1989; U.S. Department of Energy, Idaho Operations Office, DOE/ID-12082(89), 72 pages.

Abstract or Summary:

Summarizes the environmental surveillance program at the INEL. The results from the various monitoring programs for 1989 are presented. The environmental monitoring programs include air, water, foodstuff, and soil sampling, environmental radiation measurement and big game species, radioactive effluent, and ground water. Each of the programs are described along with the results for 1989.

Data:

air quality: gross alpha radioactivity, gross beta radioactivity, Ce-141, Cs-137, Mn-54, Ru-106, Sb-125, Sr-90, Zr-95, Am-241, Pu-238, Pu-239, Pu-240, Kr-85, tritium, particulate matter. water quality: gross alpha radioactivity, gross beta radioactivity, tritium, Sr-90, carbon tetrachloride, chloroform, 1,1,1-trichloroethane, trichloroethylene, tetrachloroethylene, 1,2-transdichloroethylene, toluene. foodstuff sampling: milk, lettuce, wheat, sheep, big game, I-129, I-131, Sr-90, tritium, Cs-137, Co-60. surface soil sampling: Cs-137, Sr-90, Pu-238, Pu-239/240, Am-241. liquid waste: radioactivity, tritium, Cr-51, Co-60, Ru-106, Cs-137, Na-24, Sr-90, Ce-144, Pu-(total). airborne waste: radioactivity, Kr-85, Ar-41, Xe-133, Xe-135, Xe-138, Kr-88, Kr-87, Xe-135m, Kr-85m, Cs-138, Rb-89, Rb-88, Ba-139, Br-82, Na-24, Cr-51, Ru-106, Y-91m, Sb-125, Cs-137, Sr-90, Pu(total), tritium, C-14, I-129, I-132, I-133, I-131, nitrogen oxide, nitrogen dioxide, sulfur dioxide.

Hubbell, J.M., 1990. Monitoring and Sampling Perched Ground Water in a Basaltic Terrain; EG&G Idaho, Inc., EGG-M-89491, 15 pages.

Abstract or Summary:

This paper describes the distribution and characteristics of perched ground water at the RWMC at the INEL. It discusses perched water below the surficial sediments in wells at the RWMC, the characteristics of chemical contaminant transport in the unsaturated zone of water, and the lateral extent of perched water.

Recommendations are made to increase the probability of detecting and sampling low yield perched water zone.

Data:

generalized stratigraphy, Henry's constant, vapor concentration, perched water: altitude, thickness, hydrograph, water quality, radioactivity, tritium, Sr-90, Cs-137, Co-60, Pu-238, Pu-240, Am-241, pH, carbon tetrachloride, chloroform, 1,1,1-trichloroethane, trichloroethylene, tetrachloroethylene, toluene, 1,1-dichloroethane, 1,1-dichloroethylene.

Hubbell, J.M., 1990. Perched Ground Water at the Radioactive Waste Management Complex of the Idaho National Engineering Laboratory; EG&G Idaho, Inc., EGG-ER-8779, 79 pages.

Abstract or Summary:

This report is an assessment of the presence, extent, source and quality of perched ground water at the Radioactive Waste Management Complex (RWMC). It was written to aid in the overall understanding of the hydrogeologic environment of the unsaturated zone at the RWMC. Perched ground water (a zone of saturation above the water table) at the RWMC is used as an indicator of the contaminants of water percolation toward the underlying Snake River Plain aquifer. Perched ground water has not been found in all of the wells drilled at the RWMC. Of the 45 wells drilled at the RWMC, 6 have detected standing or perched water. Perched water has been detected within basalt at two depth intervals (80 to 100 ft and 180 to 220 ft below land surface) immediately above the 110- and 240-ft sedimentary interbeds. Fine-grained layers in the interbeds or dense, low-permeability basalts above the interbeds appear to cause the perching. Two wells have detected perched water above the 110-ft interbed. Perched water zones above this interbed are discontinuous (not present in all wells) and ephemeral (present during portions of the year). Water level data from one of the wells indicate annual precipitation contributes water to this perched water zone. Four wells have detected perched water above the 240-ft interbed. Perched water above this interbed appears to be laterally extensive (extends large distances) but is not continuous beneath the RWMC (not found at all locations). The maximum saturated thickness above the 240-ft interbed is estimated to be 12 ft based on neutron logging. The rate of inflow to one of the wells mirrors inflow to spreading areas located 1 mile to the south and west of the Subsurface Disposal Area. This suggests the spreading areas contribute water to this well. The rate of inflow to the well was also influenced by flooding in 1982. Water level data show seasonal fluctuations indicating precipitation also contributes water to the well. No radionuclides have been detected in perched water wells since 1980. Only Well 92 detected various radionuclides from 1976 to 1980 following completion of the well. This may be related to (a) the high pH in the well from cement placed in the well to seal the bottom or (b) cross contamination in the well from drilling. Eleven purgeable organic compounds have been detected in Well 92 and five in Well 8802D at approximately 200 ft below land surface. Water Samples from Well 77-2 had concentrations of tritium that indicated water moved from land surface to more than 80 ft below land surface from 1952 to 1978. Measured concentration of tritium in Well 77-2 suggest a source of tritium other than atmospheric precipitation.

Data:

Analyses for trace metals and general chemistry from wells above the 110- and 240-ft interbeds do not indicate contamination from overlying waste products. precipitation, driller's log. perched water: altitude, thickness, water levels, sodium, potassium, calcium, magnesium, silicon dioxide, boron, lithium, strontium, zinc, bicarbonate, chloride, fluorine, sulfate, aluminum, bromine, phosphate, total dissolved solids, temperature, pH, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, selenium, silver, thallium, vanadium, tin, specific conductance, tritium, Sr-90, Pu-238, Pu-239/240, Am-241, Cs-137, Co-60, Ce-144, carbon tetrachloride, chloroform, 1,1,1-Trichloroethane, trichloroethylene, dichlorodifluoromethane, toluene, 1,1-dichloroethane, 1,1-dichloroethylene. wells: construction, geology, geophysical logs. recharge: spreading areas.

Hull, L.C., 1987. Hydrogeologic Assessment of Land Disposal Unit, CPP-37 ICPP Gravel Pit 2; EG&G Idaho, Inc., 179 pages.

Abstract or Summary:

This report describes the geology and hydrology of the Land Disposal Unit CPP-37, which consists of Gravel Pit 2 in the northeast corner of the ICPP compound at the INEL. Extensive work over the past 30 years provides a very good picture of the geologic and hydrologic characteristics of the INEL. Detailed lithologic descriptions of the geology are available for subsurface and surface strata. Detailed information is available for many aspects of the hydrogeologic assessment from existing data. The first sections of this report summarize the existing data. The final section discusses additional data that may be needed to complete the hydrogeologic assessment.

Data:

generalized stratigraphy, cation exchange capacity, distribution coefficient, grain size distribution, transmissivity, hydraulic conductivity, dispersivity, porosity, velocity, storage coefficient, specific yield, bulk density, moisture content, generalized lithology, caliper log, gamma-ray log, gamma-gamma log, borehole log, mineralogy, calcite, quartz, plagioclase, augite, olivine, chlorite, kaolinite, illite, montmorillonite, carbonate content, pyroxene, water quality: specific conductance.

Hull, L.C., 1989. Conceptual Model and Description of the Affected Environment for the TRA Warm Waste Pond (Waste Management Unit TRA-03); EG&G Idaho, Inc., EGG-ER-8644, 146 pages.

Abstract or Summary:

This report discusses the development of a conceptual model of the movement of water and contaminants associated with the TRA warm waste pond based on an analysis of existing data. The conceptual model is a verbal description of the processes which are important for contaminant migration. As such, it serves as a summary of what is known about the warm waste pond and the hydrogeologic system at TRA. Areas of uncertainty are highlighted in the development of the conceptual model, which lead to the identification of tasks needed to complete site characterization.

Data:

history, generalized stratigraphy, generalized lithology, gamma-ray log, caliper log, annual wind rose, Big Lost River discharge, regional water table, transmissivity, storage coefficient, velocity, ecology, solubility, unsaturated zone: hydraulic conductivity, thickness, dispersivity, porosity, velocity, liquid waste: volume, radioactivity, chromium, Co-60, Cr-51, Cs-134, Cs-137, tritium, Sr-90, perched water: altitude, areal extent, recharge source, specific conductance, tritium, chromium, surficial sediment: thickness, grain size distribution, bulk density, porosity, hydraulic conductivity, water quality: specific conductance, sodium, chloride, nitrate, sulfate, magnesium, calcium, potassium, pH, chromium, distribution coefficient: Cr-51, Co-60, Cs-134, Cs-137, tritium, Sr-90, Am-241, Cm-244, U-232, U-234, U-238, Pu-238, Pu-239, retardation factor: Cr-51, Co-60, Cs-134, Cs-137, tritium, Sr-90, Am-241, Cm-244, U-232, U-234, U-238, Pu-238, Pu-239, surficial sediment-pond sediment: concentration profile, arsenic, beryllium, cadmium, chromium, lead, mercury, Cr-51, Co-60, Cs-134, Cs-137, Sr-90, Am-241, U-232, U-234, U-238, Pu-238, Pu-239, Cm-244, background concentrations: arsenic, beryllium, cadmium, chromium, lead, mercury.

Humphrey, T.G., 1980. Subsurface Migration of Radionuclides at the Radioactive Waste Management Complex 1978; EG&G, Idaho, Inc., EGG-2026, 33 pages.

Abstract or Summary:

An investigation conducted by EG&G Idaho to determine the extent of radionuclide migration from waste buried at the Radioactive Waste Management Complex (RWMC), the Idaho National Engineering Lab, is described in a series of investigations conducted with the same objectives. The first investigation by the USGS in 1971-72 stated that limited radionuclide migration had taken place to a depth of about 73 meters; however, artificial contamination of samples either in handling or in analysis, may have been a factor. The second investigation was by the Energy Research and Development Administration in 1975. Analysis of samples showed no detectable quantities of waste radionuclides and the investigation concluded that migration, like that reported by the USGS, had not taken place. The third investigation was in 1976-77. In that study samples were obtained from wells drilled adjacent to the waste during previous investigations. Samples were also collected from undisturbed soil directly beneath buried waste. Analysis obtained from beneath the waste showed limited waste migration to a depth of about two meters. Positive results were obtained in a few well samples to depths of about 70 meters. To confirm these positive results, samples were reanalyzed where enough material was available. Reanalysis failed to confirm the presence of waste radionuclides. In the present work, samples of subsurface materials were collected from core drilled wells and from sample trenches excavated beneath the waste. Sample materials were radiochemically analyzed and the results were discussed. It was concluded that radionuclide migration is not now a hazard to the Snake River Plain aquifer.

Data:

lithologic log, surficial sediment, radioactivity, Pu-238, Pu-240, Am-241, Sr-90, Ce-144, Cs-137 and Co-60, sedimentary interbeds, Pu-238, Pu-240, Am-241, Sr-90, Ce-144, Cs-137 and Co-60

Humphrey, T.G., T.H. Smith and M.C. Pope, 1981. Projected Subsurface Migration of Radionuclides from Buried INEL Transuranic Waste; EG&G Idaho, Inc., in Nuclear Technology Volume 58, 13 pages.

Abstract or Summary:

Several alternative methods are being considered for the long-term isolation of buried transuranic waste at the INEL. One important factor in selecting an alternative is the potential subsurface migration of radionuclides from the waste. Migration projections based on mathematical modeling have been developed for three alternative isolation methods: leave as is, improve in place confinement, and retrieve and ship to an offsite repository. The projection suggests that radionuclides will not migrate in significant concentrations. Results of subsurface sampling studies suggest that very limited migration has occurred in the 25 years since the waste was buried.

Data:

Waste, non-buried waste, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Am-241, U-233, U-235, U-238, Tl-60, Ni-59, Sr-90 and Cs-137, modeling results.

Humphrey, T.G. and F.H. Tingey, 1978. The Subsurface Migration of Radionuclides at the Radioactive Waste Management Complex 1976-1977; EG&G Idaho, Inc., TREE-1171, 98 pages.

Abstract or Summary:

Samples of subsurface material from the RWMC at the INEL were collected and radiochemically analyzed. The purpose of this study was to determine the extent of radionuclide migration from buried waste. The material came from eight core drilled wells and from four sample trenches excavated beneath buried waste. One well provided deeper samples from directly under buried waste. It is concluded from this study that radionuclide migration will not be a future hazard to the Snake River Plain aquifer under present climatic conditions.

Data:

generalized lithology, gamma-ray log, gamma-gamma log, neutron log, borehole log, perched water: location, radioactivity, Pu-238, Pu-239, Pu-240, Am-241, Sr-90, Ce-144, Cs-137, Co-60, tritium. surficial sediment (subpit): radioactivity, Pu-238, Pu-239, Pu-240, Ce-144, Cs-137, Co-60. surface soil: Pu-238, Pu-239, Pu-240, Cs-137, Ce-144, Co-60. sedimentary interbed: radioactivity, Pu-238, Pu-239, Pu-240, Am-241, Sr-90, Ce-144, Cs-137, Co-60. basalt: radioactivity, Pu-238, Pu-239, Pu-240, Am-241, Sr-90, Cs-137, Ce-144, Co-60.

Idaho Department of Health and Welfare and EG&G Idaho, Inc., 1990. INEL's Test Reactor Area (TRA) Evaporation Pond -- Prevention of Significant Deterioration (PSD) Application for a Permit to Construct (PTC) - - PUBLIC COMMENT PACKAGE; Idaho Department of Health and Welfare.

Abstract or Summary:

This three volume set contains information about an application for an evaporation pond at the Test Reactor Area (TRA) at INEL. They include the application, correspondence, and a record of public comment. Since the pond will be lined, tritium will be released into the air, so a permit is necessary. These documents contain some data on quantity and quality of the waste stream from TRA as well as a calculation of potential dosage from the site.

Data:

waste stream: discharge, Ba-140, Ba-141, Ce-141, Ce-143, Ce-144, Co-58, Co-60, Cr-51, Cs-134, Cs-137, Cs-138, H-3, I-129, I-131, I-132, I-133, I-134, I-135, La-140, La-142, Lu-177, Mn-54, Mo-99, Na-24, Nb-95, Nb-97, Nd-147, Np- 239, Rb-88, Rb-89, Re-188, Ru-103, Ru-106, Sc-46, Sr-89, Sr-90, Sr-91, Sr-92, Sm-153, Ta-182, Tc-99m, Te-132, W-187, Y-90m, Y-92, Y-93, Zr-95, Zr-97, tritium. resuspension rates, airborne waste: dispersion factors

Jones, J.R., M. Deutsch, and P.T. Voegeli, 1951. Geology and Ground Water at Site 3, Reactor Testing Station, Idaho; U.S. Geological Survey, IDO-22002-USGS, 34 pages.

Abstract or Summary:

Summary of the principal results of a detailed study of the ground water and geology of Site 3 (NRF) on the NRTS. The investigations emphasize evaluation, development, conservation, and protection of ground water resources. The geologic information gathered is useful in engineering planning and design, well construction, liquid waste disposal, drainage, road construction, and excavation. Emphasis is on the rocks, soils and sediments present at the land surface, their types, surficial distribution, and probable subsurface extensions.

Data:

grain size distribution, near surface stratigraphy, fence diagram,
discharge-drawdown, drillers log

Jones, J.R. and S.L. Jones, 1952. Logs of Test Holes in the Central Snake River Plain, Idaho; U.S. Geological Survey, IDO-22015-USGS, 96 pages.

Abstract or Summary:

Presents the preliminary drillers logs of 11 test holes, three abandoned holes, and two production wells. The logs are descriptions of the materials and conditions encountered during drilling. Brief descriptions of the methods of drilling, the methods of collecting, handling and studying samples of drill cuttings, and the system used for numbering wells and test holes are provided.

Data:

drillers logs

Jones, J.R. and P.T. Voegeli, 1951. Geology and Ground Water at Site 2A, Reactor Testing Station, Idaho; U.S. Geological Survey, IDO-22001-USGS, 43 pages.

Abstract or Summary:

Summary of the principal results of a detailed study of the ground water and geology of Site 2A (MTR) on the NRTS. The investigations emphasize evaluation, development, conservation, and protection of ground water resources. The geologic information gathered is useful in engineering planning and design, well construction, liquid waste disposal, drainage, road construction, and excavation. Emphasis is on the rocks, soils and sediments present at the land surface, their types, surficial distribution, and probable subsurface extensions.

Data:

grain size distribution, discharge-drawdown, near surface stratigraphy, fence diagram, subsurface basalt contour

Jones, P.H., 1961. Hydrology of Radioactive Waste Disposal at the Idaho Chemical Processing Plant National Reactor Testing Station, Idaho; U.S. Geological Survey, IDO-22041-USGS, 9 pages.

Abstract or Summary:

This report briefly describes work recently completed and in progress to determine the capacity of the Snake River Plain aquifer in the vicinity of the ICPP to receive and attenuate radioactive waste.

Data:

generalized lithology, caliper log, gamma-ray log. liquid waste: volume, radioactivity, sodium distribution.

Jones, P.H., 1961. Hydrology of Waste Disposal National Reactor Testing Station Idaho; U.S. Geological Survey, IDO-22042-USGS, 82 pages.

Abstract or Summary:

First year summary of advanced research on the hydrology of waste disposal at the NRTS. The purpose of the research is to provide detailed and accurate information on the occurrence, movement, quality, and geologic environment of water beneath the land surface. Primary to these investigations is research on the principles of basalt hydrology which is necessary to trace the movement and observe and interpret attenuation of radioactive waste discharged to the ground. Special emphasis is given to study of conditions in the vicinity of the ICPP and MTR-ETR (TRA) facilities. The report discusses the adoption of gamma-ray logging and other new tools and methods to identify aquifers and their ability to transmit water, hydraulic head and quality of water.

Data:

liquid waste: volume, radioactivity, source, Sr-90, I-131, Ce-144, Zr- 95, Nb-95, Cs-137, Ru-106, Rh-106. stratigraphy, lithologic logs, gamma-ray logs, caliper logs, subsurface basalt contour, uppermost extensive sedimentary interbed contour, lowermost extensive sedimentary interbed contour, basalt chemical analysis, regional water table. perched water: TRA, ICPP, altitude, thickness, extent, temperature, specific conductance, tritium. aquifer: depth, altitude, thickness, structure. straddle packer test, injection test. water quality: chloride, temperature, resistivity, specific conductance, sodium, tritium.

Kaminsky, J.F., 1991. In Situ Characterization of Unsaturated Hydraulic Properties of Surficial Sediments Adjacent to the Radioactive Waste Management Complex, Idaho National Engineering Laboratory, Idaho; Idaho State University, 6 pages.

Abstract or Summary:

Unsaturated flow properties of surficial sediments at the Radioactive Waste Management Complex (RWMC) Idaho National Engineering Laboratory are required data for input to numerical models used to simulate migration of radionuclides in the unsaturated zone. In situ estimates of hydraulic properties of surficial sediments adjacent to the RWMC were obtained from a field infiltration/drainage test instrumented with tensiometers and two neutron probe access tubes which was flooded for 24 hours, then covered and allowed to drain. The unsaturated hydraulic properties were estimated by the instantaneous profile (K-Theta) and the unit gradient (D/K D-Theta) methods and were analyzed using the Fortran code UNGRA. This program uses a non-linear least squares analysis to estimate the parameters of soil hydraulic properties and fit analytical functions to observe retention and unsaturated hydraulic conductivity data. The soil water retention function was described using the equation of Van Genuchten (1980) and the unsaturated hydraulic conductivity functions obtained by the combination of Van Genuchten retention function with a pore-size distribution model of Maulem (1976). Five different types of data sets were used in parameter estimation. These sets were: retention data with instantaneous file K-Theta data; K-Theta alone; retention with unit gradient D/K D-Theta data; and unit gradient D/K D-Theta data alone. In the majority of cases graphical results were similar between measured and predicted curves of both retention and hydraulic conductivity data, although hydraulic parameters estimated from curve fitting showed little similarity. These plots also showed that unit gradient measurement can be substituted to obtain instantaneous profile measurements and also provide results over a greater range of hydraulic conductivity values even though tensiometer gradients were not always unity.

Data:

Capillary pressure, hydraulic gradient, grain size distribution, unsaturated hydraulic conductivity, moisture retention, moisture content, effective porosity, soil moisture mixture profile.

Kelmers, A.D., 1984. Review and Assessment of Radionuclides Sorption Information for the Basalt Waste Isolation Project Site; Oak Ridge National Laboratory, NUREG/CR--3763, 33 pages.

Abstract or Summary:

This document presents a scientific review and technological assessment of the radionuclide adsorption information reported by the Basalt Waste Isolation Project (BWIP) for the candidate high level waste repository in the Columbia River Basalt flows in the Hanford Reservation. Quantified radionuclide adsorption data are necessary for repository performance assessment calculations to model expected radioactive release rates in ground water intrusion, and ground water migration scenarios. Three key BWIP reports were identified which contain most of the sorption information for a number of radionuclides with basalt secondary mineral or interbed materials. An extended review of these data is presented in the document. The technological assessment identified seven potentially significant deficiencies in the radionuclide sorption information published by BWIP that could lead to questionable or non-conservative radioactivity release calculations. These deficiencies are discussed in the document in detail. Specific additional information needs were also defined and reported.

Data:

No data are presented relative to INEL

Kirschner, F.E. and G.L. Bloomsburg, 1988. Vadose Zone Monitoring, an Early Warning System; University of Idaho, in Ground Water Monitoring Review, Spring 1988, 2 pages.

Abstract or Summary:

Currently vadose zone monitoring is required under the Resource Conservation and Recovery Act only at land treatment facilities. Containment leak detections through ground water monitoring is very important, but it is considered to be after the fact. Remedial action costs can be reduced considerably by monitoring the vadose zone for compounds that exhibit high rates of movement. Volatile organic compounds (VOC) exhibit this property and are present at many municipal landfills, recycling facilities and treatment storage and disposal facilities. Through the authors personal experience it has been noted that gaseous phase transport of VOCs through the vadose zone is at least an order of magnitude greater than advective transport of VOC in ground water, therefore, VOC's in soil gas are an effective early warning leak detection parameter. Downward movement of leachate can be intercepted by porous cup lysimeters. Attenuation in the vadose zone slows the apparent movement of contaminants, however, it is only a matter of time before the leachate reaches the water table. The authors believe that soil gas and pore water monitoring should and eventually will be required at all RCRA sites. If vadose zone monitoring becomes an additional requirement under RCRA both the facility, owner and the taxpayer will benefit. During the interim facility owners can benefit by employing vadose zone monitoring techniques coupled with either qualitative or quantitative chemical analysis.

Data:

No data are presented.

Knutson, C.F., K.A. McCormick, R.P. Smith, W.R. Hackett, J.P. O'Brien and J.C. Crocker, 1989. FY 89 Report RWMC Vadose Zone Basalt Characterization; EG&G Idaho, Inc., EGG-WM-8949, 414 pages.

Abstract or Summary:

This report summarizes the petrological information developed as an initial step in the characterization of basalt in the vadose zone beneath the RWMC. The study was based on the concept of modified plains volcanism, which explains the emplacement of basalt lava flows on the Eastern Snake River Plain. A petrologic study, including lithologic logging of the core and representative samples of basalt, was performed. Subsequent studies of the core samples were also conducted. Petrophysical studies were performed measuring porosity, permeability, grain density, equilibrium water saturation, and pore-size distribution of flow groups. Thin cylindrical slices were cut from petrophysical plugs, and petrographic studies analyzing texture and mineralogy were accomplished using a petrographic microscope. These studies, along with geostatistical studies of Box Canyon of the Big Lost River and Hell's Half Acre, resulted in a conceptual geologic model of the basalt of the vadose zone under the RWMC. The evaluation of the preliminary model was used as a basis for recommendations of subsequent data acquisition efforts.

Data:

basalt: porosity, permeability, grain density, bulk density, equilibrium water saturation, flow unit, petrography, vesicle size, percent vesicles, maximum vesicle size, lithologic log, mineralogy, plagioclase, olivine, matrix, fence diagram, flow geometry.

Koeppen, L.D., C. Casey, D.W. McBride, R.J. Gehrke, 1988. Gamma-Ray Analysis of TRA Warm Waste Leaching Pond Soil and Water Samples for the Consent Order and Compliance Agreement (COCA) Sampling Program; EG&G Idaho, Inc., ST-CS-039-88, 61 pages.

Abstract or Summary:

This report contains the results from the gamma-ray analysis of soil and water samples from the TRA warm waste leaching ponds. Seventy-six soil samples from twenty-one boreholes at the leaching pond site were counted/analyzed using Ge gamma-ray spectrometry. The subject sample spectra have been analyzed by the RML VAX Computer for gamma-ray emitting radionuclides. Gamma-ray analysis of spectra from these samples was accomplished using the GNUL (Gamma-ray analysis No Upper Limit) program.

Data:

gamma-ray logs

Koslow, K.N., and D.H. Van Haeften, 1986. Flood Routing Analysis for a Failure of Mackay Dam; EG&G Idaho, Inc., EGG-EP-7184, 86 pages.

Abstract or Summary:

The objective of this report is to provide basic information necessary to establish the appropriate level of protection for Idaho National Engineering Laboratory (INEL) facilities from possible flooding of the Big Lost River due to a failure of Mackay Dam. The study results provide the basis for assessing and developing a flood protection system for the INEL. The National Weather Service computer code DAMBRK was used to model the hydrologic consequences of a failure of Mackay Dam. Seismic, structural, and hydrologic overtopping failures of the dam were examined. The flood wave from each dam failure scenario was calculated and routed through the Big Lost River valley to determine the maximum flooding potential downstream. Results are tabulated in the form of peak flood elevation, peak flow, wave arrival time, and maximum water velocity for several cross sections along the valley. For the conditions assumed, the study indicates flooding on parts of the INEL due to the failure of Mackay Dam. This flooding is of shallow depths and involves low water velocities, and thus poses little threat of structural damage to INEL facilities. Results of the study are not to be construed to reflect on the structural integrity of Mackay Dam in any way. In conjunction with the dam failure analysis, the potential for snowmelt runoff near the INEL facilities was evaluated in a separate study, presented in Appendix A. Local runoff resulting from the simultaneous occurrence of melting snow and heavy rains does not pose a threat to the facilities if accepted practices of local runoff control are followed. Appendix B presents the study that determined the Probable Maximum Precipitation that was prepared by a consultant (D.L. Schreiber). Appendix C is a sensitivity study of the dam break analysis.

Data:

Big Lost River, channel cross sections, channel roughness coefficients, dam break, flooding, snow pack, capacity; Mackay Dam, diversion area, spillway, discharge, flood frequency, flood routing, hydrograph; Big Lost River, INEL diversion discharge, seismic activity; faults, earthquakes, snow fall, snow melt, velocity.

Krivanek, K.R., 1988. ICPP Environmental Monitoring Report CY-1987; Westinghouse Idaho Nuclear Company, Inc., WINCO-1055, 39 pages.

Abstract or Summary:

Summarized in this report are the data collected through environmental monitoring programs conducted at the ICPP.

Data:

monitoring program. airborne waste: volume, radioactivity, tritium, Pu-total, Cs-137, Cs-137, Ru-106, Sb-125, Sr-90, C-14, I-129, Cs-134, Co-60, Th-234, nitrogen oxide, sulfur dioxide, opacity. liquid waste: volume, radioactivity, Ce-144, Co-60, Cs-134, Cs-137, tritium, I-129, Nb-95, Pu-total, Ru-106, Sb-125, Sr-89, Sr-90, U-total, Zr-95, Eu-54, arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, total dissolved solids, electrical conductivity, pH, BOD, DO water quality: arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver

Lamke, R.D., 1969. Stage-Discharge relations on Big Lost River within NRTS, Idaho; U.S. Geological Survey, IDO-22050, 29 pages.

Abstract or Summary:

Theoretical stage-discharge relations (ratings curves) were computed for 11 selected sites on the Big Lost River system within the NRTS and are given in this report. The sites examined were located either at the diversion area or in the playas. These ratings curves were computed by various techniques, which are dependent upon the hydraulic characteristics of each site. Relative accuracies of the rating curves are shown by presenting the curves of higher accuracy as solid lines and the curves of lower accuracy by dashed lines. The rating curves apply only for the stated conditions and for the physical and hydraulic characteristics existing in April 1968. After a large flood the curves could be considerably different because of erosion of the channels, dikes, and road embankments. Also, the curves for the culverts are for conditions of no debris at the entrances and in the barrels.

Data:

stage-discharge relations.

Leenheer, J.A. and J.C. Bagby, 1982. Organic Solutes in Groundwater at the Idaho National Engineering Laboratory; U.S. Geological Survey, IDO-22061, 39 pages.

Abstract or Summary:

Summarizes the results of a reconnaissance survey of organic solutes in drinking water sources, ground-water monitoring wells, perched water table monitoring wells, and in selected waste streams at the INEL. Seventy-seven wells and 4 potential point sources were sampled for dissolved organic carbon (DOC). Four wells and several potential point sources of insecticides and herbicides were sampled for insecticides and herbicides. Fourteen wells and four potential organic sources were sampled for volatile and semivolatile organic compounds. The results of the DOC analyses indicate no high level organic contamination of INEL ground water. The only detectable insecticide or herbicide was a DDT concentration of 10 parts per trillion. The volatile and semivolatile analyses do not indicate the presence of hazardous organic contaminants in significant amounts.

Data:

water quality: dissolved organic compounds, VOCs, semivolatile organic compounds, herbicide, insecticide, DDT

Lewis, B.D., J.M. Eagleton and R.G. Jensen, 1985. Aqueous Radioactive- and Industrial-Waste Disposal at the Idaho National Engineering Laboratory through 1982; U.S. Geological Survey, DOE/ID-22069, 77 pages.

Abstract or Summary:

During the many years of INEL operations, low-level radioactive and chemical wastes have been disposed of directly or indirectly into the Snake River Plain aquifer which underlies the INEL. Some wastes have been disposed to leaching ponds, ditches, or subsurface leaching fields, and these wastes have migrated downward to the aquifer. Other wastes have reached the aquifer by direct injection through disposal wells. The aqueous waste disposal data, plus related and pertinent hydrologic and ground water quality data, have been assembled on magnetic computer tape and are now available for comparison and evaluation of various digital ground water solute transport models.

Data:

liquid waste: concentration, radioactivity, volume, Cs-137, tritium, Sr- 90, I-129, Co-60, hypochlorite, chloride, sodium, calcium, phosphate, sulfite, sulfate, nitrate, zinc, potassium.

Lewis, B.D. and F.J. Goldstein, 1982. Evaluation of a Predictive Ground-Water Solute-Transport Model at the Idaho National Engineering Laboratory Idaho; U.S. Geological Survey, IDO-22062, 71 pages.

Abstract or Summary:

In 1973, a digital chemical solute-transport modeling study at the INEL had been used to project chloride and tritium waste plumes for 1980. The model indicated that for the conditions assumed, the wastes would be at or near the INEL southern boundary by 1980. Eight wells were drilled during the summer of 1980 near the southern boundary to fill existing gaps in the INEL hydrogeological data base, to delineate the leading edge of the waste plumes, and to monitor for first arrivals of aqueous wastes at the exiting boundary of the INEL. The data from the eight wells were used to evaluate the accuracy of the predictive model, and the assumptions used. Data interpretation from the drilling program indicates that the subsurface geology in the southwestern INEL vicinity is dominated by thin basalt flows interbedded with layers of sediment. Silicic rocks are penetrated only in those wells near the INEL's southern boundary. The Arco volcanic rift zone was found to have a marked effect on the regional ground water flow regimen, and perhaps, on water quality. This same subsurface geologic structure appears to have lower water-yielding and transmitting capabilities than the surrounding aquifer matrix and retards the movement of aqueous wastes. Interpretation of data also indicates that the leading edges of the chloride and tritium waste plumes are 2 to 3 miles upgradient from the southern boundary of the INEL, and higher than background specific conductance values are measurable at about the same upgradient distance. As expected, the waste plumes projected by the computer model for 1980 extended somewhat further downgradient than indicated by well data due to conservative worst-case assumptions in the model input and inaccurate approximations of subsequent waste discharge and aquifer recharge conditions.

Data:

velocity, transmissivity, regional water table, Big Lost River discharge, well hydrograph, generalized lithology, caliper log, gamma-ray log, gamma-gamma log, neutron log, generalized stratigraphy. liquid waste: radioactivity, volume. water quality: tritium, chloride, specific conductance, pH, temperature, calcium, magnesium, sodium, sodium adsorption ration, potassium, total alkalinity, silica, sulfate, fluoride.

Lewis, B.D. and R.G. Jensen, 1984. Hydrologic Conditions at the Idaho National Engineering Laboratory, Idaho: 1979-1981 Update; U.S. Geological Survey, IDO-22066, 65 pages.

Abstract or Summary:

Aqueous chemical and radioactive wastes have been discharged to shallow ponds and to shallow or deep wells on the INEL since 1952 and have affected the quality of the ground water in the underlying Snake River Plain aquifer. Ongoing studies from 1979 through 1981 have shown the perpetuation of a perched ground water zone in the basalt underlying the waste disposal ponds at the TRA and of several waste plumes in the regional aquifer created by deep well disposal at the ICPP. The perched zone contains tritium, Cr-51, Co-60, Sr-90, and several nonradioactive chemicals. Tritiated waste water has formed the largest plume south of the ICPP, and accounts for 99 percent of the total radioactivity disposed of through the ICPP disposal well. Waste plumes with similar configurations and flow paths contain sodium, chloride, nitrate, and I-129. Sr-90 and Cs-137 are also discharged through the well but they are sorbed from solution as they move through the aquifer. Waste water containing Sr-90 has formed a small plume and Cs-137 is detectable in only a few ground water samples collected very near the ICPP disposal well. Radionuclide plume size and concentrations therein are controlled by aquifer flow conditions, the quantity discharged, radioactive decay, sorption, dilution by dispersion, and perhaps other chemical reactions. Chemical wastes are subject to the same processes except for radioactive decay.

Data:

regional water table, velocity, transmissivity, pumpage, well hydrograph. perched water: TRA areal extent, altitude, tritium, Cr-51, Co-60, Sr-90, specific conductance, sodium, chromium, chloride, sulfate, nitrate, phosphate. liquid waste: radioactivity, concentration, sulfate, sodium, chloride, tritium, Sr-90, Co-60, Cr-51, Cs-137, Pu-238, Pu-239, Pu-240. water quality: distribution, concentration, tritium, Sr-90, I-129, specific conductance, sodium, chloride, nitrate.

Ludi, K.M., S.M. Burns, C.K. Hardy, H.N. Fugate, R.R. MacKinnon, and S.N. Stanisich, 1990. Informal Report -- Closure Plan for the Power Burst Facility Corrosive Waste Sump and the Power Burst Facility Evaporation Pond (COCA Units PBF-08 and PBF-10); EG&G Idaho, Inc., EGG-WM-8996, 88 pages.

Abstract or Summary:

Chemical and radiological analyses were conducted at the Power Burst Facility to determine the method of closure for the Power Burst Facility Corrosive Waste Sump, Waste Management Unit PBF-08 and Evaporation Pond, Waste Management Unit PBF-10. General and specific descriptions of the site that included topographical, geological, meteorological, ecological, and hydrological information were provided. Analytical results indicated relatively high concentrations of cesium-137, in addition to detectable amounts of metal contaminants. No significant organic contamination was found. EP Toxicity Tests were conducted to confirm that toxic metals were tightly adsorbed to the soil matrix and less than the toxicity characteristic for hazardous waste. The pond sediments were determined to be radioactively contaminated, and volatile organic compounds were detected in the sump in concentrations greater than established action levels. EPA guidance documents were used to determine the procedures to be followed for closure. These procedures include sump decontamination, contaminated sediment removal, loading and transportation of hazardous waste, liner removal, dust control, and verification sampling. Decontamination procedures will be strictly adhered to, and a professional engineer will inspect the facility and certify the closure of the Power Burst Facility Corrosive Waste Sump and Evaporation Pond.

Data:

aquifer: depth, thickness. ecology: flora, fauna. transmissivity, storativity, recharge: Snake River. regional water table, small mammals, vegetation. surficial sediments: thickness, specific chemical, aluminum, arsenic, barium, beryllium, calcium, chromium, copper, iron, lead, manganese, magnesium, mercury, vanadium, zinc, selenium, silver, specific radionuclide, cesium-134, cesium-137. fence diagram, driller's log. well: depth, location. liquid waste: source, sulfuric acid, sodium hydroxide, trivalent chromium, Cr.

Mann, L.J., 1989. Tritium Concentrations in Flow from Selected Springs that Discharge to the Snake River, Twin Falls -- Hagerman Area, Idaho; U.S. Geological Survey, DOE/ID-22084, 20 pages.

Abstract or Summary:

Concern has been expressed that some of the approximately 30,900 curies of tritium disposed to the Snake River Plain aquifer from 1952 to 1988 at the INEL (Idaho National Engineering Laboratory) has migrated to springs that discharge to the Snake River in the Twin Falls-Hagerman area. To document tritium concentrations in springflow, 17 springs were sampled in November 1988 and 19 springs were sampled in March 1989. Analyses showed that the tritium concentrations were less than the minimum detectable concentration of about 0.5 pCi/ml (picocuries per milliliter) in November 1988 and less than the minimum detectable concentration of about 0.2 pCi/ml in March 1989; the minimum detectable concentration was smaller in March 1989 owing to a longer counting time in the liquid scintillation system. For comparison, the maximum contaminant level of tritium in drinking water as established by the U.S. Environmental Protection Agency is 20 pCi/ml. Samples analyzed by the U.S. Environmental Protection Agency indicate there has been a subtle decrease in tritium concentrations in the Snake River near Buhl since the 1970s owing to the radioactive decay of tritium that was produced by atmospheric testing of nuclear weapons in the 1950s and 1960s. In 1974-79, the concentrations were less than 0.3 ± 0.2 pCi/ml in 3 of 20 samples, whereas, in 1983-88, 17 of 23 samples contained less than 0.3 ± 0.2 pCi/ml of tritium; the minimum detectable concentration is 0.2 pCi/ml. On the basis of these findings, aqueous waste disposal of tritium at the INEL has had no measurable effect on tritium concentrations in the springflow discharging from the Snake River Plain aquifer and in the Snake River near Buhl. This conclusion is supported by the distribution of tritium in the Snake River Plain aquifer as delineated by Pittman et al. (1988, Hydrologic conditions at the Idaho National Engineering Laboratory, 1982 to 1985: DOE/ID-22078).

Data:

ground water discharge. discharge: Snake River. water quality: tritium, volume, Ph, specific conductance, temperature, dissolved oxygen.

Mann, L.J., 1990. Purgeable Organic Compounds in Groundwater at the Idaho National Engineering Laboratory, Idaho 1988 and 1989; U.S. Geological Survey, DOE/ID-22089, 17 pages.

Abstract or Summary:

Ground water samples from 38 wells at the INEL were analyzed for 36 purgeable organic compounds in 1988-89. The samples were collected and analyzed as a continuation of a water quality program initiated in 1987. Thirty-six of the wells obtain water from the Snake River Plain aquifer and were equipped with dedicated or portable pumps. Water samples from one well that obtains water from the aquifer and one that obtains water from a perched ground water zone were collected using a thief sampler. Analyses of water from 22 wells indicated that the aquifer locally contained detectable concentrations of a least 1 of 19 purgeable organic compounds. Except for five wells, the maximum concentration of a specific compound in ground water was 6.4 micrograms per liter or less; the concentration of most compounds were less than 0.2 micrograms per liter. Water from four wells at and near the TAN contained 44 to 29,000 micrograms per liter. Water from a well that obtains water from a discontinuous perched ground water zone at the RWMC contained 1,000 micrograms per liter of carbon tetrachloride, 950 micrograms per liter of chloroform, 250 micrograms per liter of 1,1,1-trichloroethane, and 1,100 micrograms per liter of trichloroethylene.

Data:

water quality: benzene, bromoform, carbon tetrachloride, chlorobenzene, chloroethane, 2-chloroethyl vinyl ether, chloroform, chloromethane, dibromochloromethane, dichlorobromomethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, dichlorodifluoromethane, 1,2-dibromoethylene, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethylene, 1,2-trans-dichloroethylene, 1,2-dichloropropane, cis-1,3-dichloropropene, trans-1,3-dichloropropene, 1,3-dichloropropene, ethylbenzene, methyl bromide, styrene, methylene chloride, 1,1,2,2-tetrachloroethane, toluene, trichlorofluoromethane, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethylene, vinyl chloride, mixed xylenes.

Mann, L.J and L.D. Cecil, 1990. Tritium in Ground Water at the Idaho National Engineering Laboratory, Idaho; U.S. Geological Survey, DOE/ID-22090, 35 pages.

Abstract or Summary:

From 1952 to 1988, approximately 30,900 curies of tritium were contained in waste water generated by the ICPP and TRA at the INEL. The waste water at the ICPP was discharged directly to the Snake River Plain aquifer through a disposal well until February 9, 1984, when routine use of the well was discontinued and an unlined infiltration pond was put into use. A second pond was put into use on October 17, 1985. Waste water disposed at the TRA has been discharged at one to three infiltration ponds since 1952. The average annual concentration of tritium in water from 26 selected well at the INEL decreased from 250 pCi/ml in 1961 to 18 pCi/ml in 1988, a decrease of 93 percent. Four factors are responsible for this decrease in tritium concentration: (1) a decrease in the amount of tritium disposed annually to ponds and wells from 1961 to 1988; (2) the change from the use of a disposal well to infiltration ponds at the ICPP; (3) radioactive decay; and (4) dilution from recharge.

Data:

Big Lost River discharge, liquid waste, radioactivity, volume, tritium, water quality, distribution, tritium.

Mann, L.J., E. W. Chew, J.S. Morton, and R.B. Randolph, 1988. Iodine-129 in the Snake River Plain Aquifer at the INEL, Idaho; U.S. Geological Survey, DOE/ID-22076, 27 pages.

Abstract or Summary:

From 1953 to 1983, an estimated 0.01 to 0.136 Ci per year of iodine-129 were contained in wastewater generated by the ICPP at the INEL. The wastewater was directly discharged to the Snake River Plain aquifer through a deep disposal well until February 9, 1984, when routine use of the well was discontinued and the well was replaced by an unlined infiltration pond; a second pond was put into use on October 17, 1985. For 1984-86, the annual amount of iodine-129 in wastewater discharged to the ponds ranged from 0.0064 to 0.039 Ci. The average concentration of iodine-129 in water from 18 wells that were sampled in 1977, 1981, and 1986 was 4.0, 6.7, and 1.3 pCi/L, respectively. The marked decrease in the iodine-129 concentrations from 1981 to 1986 was the result of three factors (1) The amount of iodine-129 disposed annually; (2) a change from the routine use of the disposal well to the infiltration ponds; and (3) dilution of the iodine-129 in the aquifer by an increase in recharge from the Big Lost River. Flow on the Big Lost River at Lincoln Boulevard from 1980 to 1986 ranged from 1,100 to 100,100 AF/year. This was considerably higher than the previous six years. To determine what effect dilution had on the concentration of iodine-129, the amount of recharge to the aquifer in the 2-mile reach of the river immediately downstream from Lincoln Boulevard was estimated using the number of days during which flow occurred and the infiltration rate of water from the channel: this recharge would enter the aquifer just upgradient from the ICPP. From 1977 to 1981, flow occurred at Lincoln Boulevard on 57 days, mainly in 1981, and from 1982 to 1986 it occurred on 1,380 days. Based on this information and an average infiltration rate of 2.5 (AF/day)/mile, nearly 7,000 AF of water recharged the aquifer from 1982 to 1986 compared to about 300 AF for the period 1977 to 1981.

Data:

iodine-129, waste stream discharge, Big Lost River discharge.

Mann, L.J., and L.L. Knobel, 1990. Radionuclides, Metals and Organic Compounds in Water, Eastern Part of A and B Irrigation District, Minidoka County, Idaho; U.S. Geological Survey, DOE/ID-22087, 36 pages.

Abstract or Summary:

The U.S. Geological Survey, in response to a U.S. Department of Energy request, collected and analyzed water samples from 15 sites in Minidoka County, Idaho, for manmade pollutants and naturally occurring contaminants. Samples were collected from 12 ground water and 3 irrigation wastewater sites. Samples were analyzed for tritium, gross alpha and beta, particle radioactivity total uranium, radium, radon-222, strontium-90, gross gamma radioactivity, trace metals, purgeable organic compounds, nutrients and pesticides. Tritium concentrations were determined by the U.S. Geological Survey, U.S. Department of Energy and Idaho State University Laboratories. Seven samples had tritium concentration at larger than reporting level.

Data:

Surface water quality, surface, pH, specific conductivity, temperature, tritium, alpha particles, gross beta particles, total uranium, radium 224, 226, 228, radon 222, strontium 90, lead 212, potassium 40, cesium 60, thorium 234, arsenic, barium, chromium, silver, ammonia, nitrate, orthophosphate, carbofuran, fonofos, carbofuran, dieldrin, aldacarb, diuron, promicil, diazinon, malathion.

Martin, K.L., C.J. Barnard, A.L. Freeman, M.R. Groh, K.T. Kissel, S.J. Lord, G.L. Olsen, P.D. Randolph, and R.N. Wilhelmsen, 1990. Preliminary Assessment of Surface Soils at Active EG&G Idaho Facilities Data Document; EG&G Idaho, Inc., EGG-ESQ-9225, 786 pages.

Abstract or Summary:

The purpose of this report is to provide a comprehensive reference document on the properties, metals, and radioactive content of surface soils at active non-waste-management EG&G facilities. The purpose was accomplished by the collection and analysis of surface soil samples for soil properties, metals, and radionuclides. Results of sample analysis indicated that most soils for systematic sample locations did not have concentrations of metals or radionuclides above the concentrations noted in background samples. However, systematic sample areas at TAN were contaminated with radionuclides at concentrations well above background. Evaluation of metals concentrations in soils indicates that the soil type will have an impact on the concentration of metals detected. No correlation between soil type and radionuclide concentration was noted. The specific sites studied include the Central Facilities Area, the Power Burst Facility, Test Area North, Test Reactor Area, and a Radioactive Mixed Waste Storage Facility (SPERT-IV). Geomorphology of the sites is described. The alluvium of the Big Lost River is described (p. 66). Maps of the sample sites are presented. Maps of SCS soil classification type are given.

Data:

surficial sediment; pH, cation exchange capacity, texture, sand, silt, clay, organic carbon, radionuclides: Th-228, Th-230, Th-232, U-238, K-40, Ce-134, Ce-137, Pu-239, Co-60, Eu-152, Eu-154, Eu-155, Sb-125, metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc.

McBride, R., N.R. French, A.H. Dahl, and J.E. Detmer, 1978. **Vegetation Types in Surface Soils of the Idaho National Engineering Laboratory Site; Environmental Sciences Branch, U.S. Department of Energy, IDO-12084, 38 pages.**

Abstract or Summary:

The original delineation of potential vegetation communities was made for INEL from a set of 1949 aerial photographs of the NRTS. The second version of the vegetation map, a new set of aerial photographs taken in 1953 and 1954 was available. Ground reconnaissance was utilized to determine the species of plants most characteristic of each area delineated in the aerial photos. Where this evaluation indicated sufficient difference between two vegetation types, each was designated according to the three most prominent plant species in each area. These evaluations were qualified, however, where transects were evaluated in the vegetation sites at the position where ground reconnaissance was carried out. The quantitative measures of dominance supported the more rapid estimates made visually. The present report is an update of the vegetation maps.

Data:

Reclassification, vegetation.

McElroy, D.L. and J.M. Hubbell, 1989. Vadose Zone Monitoring at the Radioactive Waste Management Complex, Idaho National Engineering Laboratory; EG&G Idaho, Inc., EGG-M-89063, 6 pages.

Abstract or Summary:

A network of vadose zone instruments was installed in sediments at the RWMC of the INEL to measure capillary pressure and monitor water movement. The vadose zone monitoring system is part of a continuing effort to develop an understanding of the hydrogeologic and contaminant transport process at the RWMC. Instruments were installed at depths up to 70 m below land surface in a heterogeneous geologic system comprised of sediments which overlie and are intercalated with basalt flows. An array of instruments, which included psychrometers, gypsum blocks, heat-dissipation sensors, and tensiometers, porous-cup lysimeters, and neutron access tubes, were installed. This paper presents preliminary results pertaining to water movement in the surficial sediments and interbeds at the RWMC, as inferred by gypsum blocks, heat-dissipating sensors, and tensiometers. Capillary pressure ranges and trends in the surficial sediments and interbeds are discussed. Hydraulic gradients are presented for selected boreholes.

Data:

generalized stratigraphy, surficial sediment: capillary pressure, hydraulic gradient,
sedimentary interbed: capillary pressure, hydraulic gradient.

McElroy, D.L., and J.M. Hubbell, 1990. Hydrologic and Physical Properties of Sediments at the Radioactive Waste Management Complex; EG&G Idaho, Inc.: Geosciences, EGG-BG-9147, 414 pages.

Abstract or Summary:

Sediment samples from the Radioactive Waste Management Complex (RWMC) were analyzed for hydrologic and physical properties pertinent to contaminant migration at the RWMC. Thirty-five samples were subcored from archived collection of 19 core samples which were collected from surficial (less than 30 feet below land surface) and interbed sediments (approximate depths of 110, 240 and 570 below land surface). These sediments overlie and are intercalated with fractured basalts at the RWMC. Grain size distributions and particle density are representative of in-situ combinations for all of the samples. The long storage time of the samples prior to analysis yielded in-situ moisture contents which may be less than the in-situ field values. Some of the saturated hydraulic conductivities from these recent analyses were compared to hydraulic conductivity previously determined for the same samples. The results prior to storage and after two years of storage agreed within two orders of magnitude. Due to the long shelf life and sample compaction, some of the dry bulk density, moisture characteristics, saturated and unsaturated hydraulic conductivity and air permeability results have limited value and caution should be used in applying the data.

Data:

grain size distribution, bulk density, porosity, particle specific gravity, moisture retention, unsaturated hydraulic conductivity, air permeability.

McElroy, D.L., S.A. Rawson, J.M. Hubbell, S.C. Minkin, R.G. Baca, M.J. Vigil, C.J. Bonzon, J.L. Landon, P.T. Laney, 1989. Annual Progress Report: FY-1988, Site Characterization Program at the Radioactive Waste Management Complex of the Idaho National Engineering Laboratory; U.S. Department of Energy, EG&G Idaho, Inc., DOE/ID-10233(88), 54 pages.

Abstract or Summary:

The Radioactive Waste Management complex (RWMC) Site Characterization Program is a continuation of the Subsurface Investigation Program (SIP). The scope of the SIP has broadened in response to the results of past work that identified hazardous as well as radioactive contaminants in the subsurface environment and in response to the need to meet regulatory requirements. Two deep boreholes were cored at the RWMC during FY-1988. Selected sediment samples were submitted for Appendix IX of 40 CFR Part 264 and radionuclide analyses. Detailed geologic logging of archived core was initiated. Stratigraphic studies of the unsaturated zone were conducted. Studies to determine hydrologic properties of sediments and basalts were conducted. Geochemical studies and analyses were initiated to evaluate contaminant and radionuclide speciation and migration in the Subsurface Disposal Area (SDA) geochemical environment. Analyses of interbed sediments in boreholes D15 and 8801D did not confirm the presence of radionuclide contamination in the 240-ft interbed. Analyses of subsurface air and groundwater samples identified five volatile organic compounds of concern: carbon tetrachloride, trichloroethylene, 1,1,1-trichloroethane, chloroform, and tetrachloroethylene. Data from vadose zone instrumentation suggested the occurrence of downward movement of soil water for large portions of the year. Preliminary solute transport modeling under unsaturated flow conditions is in general agreement with observed radionuclide migration and subsurface water contents. These modeling results suggest that fractures may play an important role in unsaturated flow and solute transport.

Data:

lithology, stratigraphy, geophysical logging, hydraulic conductivity, temperature. sediment: Pu-239, Pu-240, Pu-238, Am-241, Sr-90. modeling: FLASH, TRACR3D, UNSAT2, FENWATER, SATURN, SUTRA, MAGNUM-3D, FECTRA-3D, VIDEO. monitoring program.

McKinney, J.D., 1985. Big Lost River 1983-1984 Flood Threat; EG&G Idaho, Inc., PPD-FPB-002, 124 pages.

Abstract or Summary:

This report documents the flooding event which occurred 1983-1984 along the Big Lost River drainage in the vicinity of the Idaho National Engineering Laboratory (INEL). The report is historical in nature, examining Big Lost River flow records and the INEL diversion system. In particular, this report discusses circumstances which resulted in the 1983-1984 record high-flows and the response taken to avert flooding in the vicinity of the INEL and at the Big Lost River Diversion system. Hydrologic response to the 1983 Mount Borah earthquake and record low temperatures in December 1983 contributed to an ice jam on the diversion system, forcing the river to pond along and nearly overtop Dike 1. Emergency efforts from the Department of Energy-Idaho Operations (DOE-ID), EG&G Idaho, Inc., Morrison-Knudsen (M-K) Construction Management, and local contractors to prevent a breach of the dike. The report also briefly discusses follow-on actions that have been or are planned to be instituted.

Data:

flooding, Big Lost River, hydrograph: Big Lost River. discharge: Big Lost River. diversion area, seepage, streamflow gage: Chilly Buttes, Mackay Reservoir, Arco, monthly. stage discharge relations, snow melt, snow pack, recharge, infiltration rate: diversion area. INEL diversion discharge, seismic activity: earthquakes, faults. temperature: air. ice jams, capacity: Mackay dam, diversion area.

Miller, S.M., J.E. Hammel, and L.F. Hall, 1990. Characterization of Soil Cover and Estimation of Water Infiltration at Central Facilities Area Landfill II, Idaho National Engineering Laboratory (INEL); University of Idaho, Idaho Water Resources Research Institute, 216 pages.

Abstract or Summary:

The soil cover at Central Facilities Area (CFA) Landfill II was characterized and the annual water infiltration through the cover was estimated. Based on historical evidence of landfill operations and on the results of particle size analyses with depth, it is reasonable to divide the soil cover into two layers: 1) an upper surface layer approximately 1-ft thick consisting of more sand than gravel, and 2) a lower layer at depths greater than 1 ft consisting of more gravel than sand. The overall thickness of the soil cover was measured with a hand auger at 60 locations across the landfill. The sample mean was 1.5 ft, with a minimum and maximum of 0.33 and 3.17 ft, respectively. Several of the auger holes collapsed or were blocked, so maximum thickness of the soil cover at several locations may be greater than 3.17 ft. A field procedure using cheese-cloth and resin was used to collect large, undisturbed specimens of coarse-grained soils. In the laboratory these blocks were trimmed to fit 8-in. diameter sections of PVC pipe for subsequent hydraulic testing. Measured saturated hydraulic conductivities ranged from 0.0020 to 0.0025 cm/sec. Water retention tests of the large cores and of smaller specimens comprised of the fine fraction (particles smaller than 2.0 mm) provided relationships of capillary pressures vs. water content. Results from these tests and from mass-volume calculations indicated that water storage in the soil cover effectively occurs in the volume occupied by the fine fraction and is approximately equal to 0.097 and 0.062 cm of water per cm of soil thickness for Layers 1 and 2, respectively. Historical meteorological data from a 31-year record was used to estimate the amount of water available for annual infiltration through the soil cover (i.e., recharge). The median value of annual (PPT-ETA) was combined with block-kriged maps of cover thickness, percent-fines in Layer 1, and percent-fines in Layer 2 to generate maps depicting the estimated annual infiltration through the cover (in 50 x 50 ft cells) for a "median" year. The cell values range from 0.99 to 2.05 in., and indicate the annual recharge to the waste. The analysis was repeated for a "dry" (0.10 quantile of PPT-ETA) year and for a "wet" (0.90 quantile of PPT-ETA) year. The former indicates annual cell recharge values of 0.00 to 0.73 in. The latter indicates annual cell recharge values of 3.50 to 4.56 in. Based on the above results, regulatory closure of CFA Landfill II will require the design and construction of a soil cap. Soil materials that contain more silt and clay than Layer 1 material will be required to economically construct a cap. In addition, ground surface sloping and a properly selected cover crop of grasses should be incorporated into any prudent design of the soil cap.

Data:

alluvial sediment, surficial sediments (landfill overburden): thickness, grain size distribution, bulk density, moisture content, moisture retention, equilibrium water saturation, radiation: solar, wind: speed, temp: air, lithology, hydraulic conductivity, evaporation, capillary pressure.

Morris, D.A., J.T. Barraclough, G.H. Chase, W.E. Teasdale and R.G. Jensen, 1965. Hydrology of Waste Disposal National Reactor Testing Station Idaho Annual Progress Report 1964; U.S. Geological Survey, IDO-22047-USGS, 185 pages.

Abstract or Summary:

Summary of research on the hydrology of waste disposal at the NRTS. Describes on-going efforts to provide detailed and accurate information on the occurrence, movement, quality, and geologic environment of water beneath the land surface. The report discusses the use of aeroradiocativity survey in conjunction with characterizing the geologic structure of the NRTS, geochemical study of the ground water, gas-injection tests, study of the TRA waste disposal pond area, the effect of the Alaskan earthquake on ground water levels, study of regional hydrology, air flow in basalt, relationship of disposal pond levels to region and perched water levels, and the sitewide drilling, geophysical and water level measurement program.

Data:

infiltration rate, well hydrograph, stream flow, generalized lithology, caliper log, gamma-ray log, gamma-gamma log, well pumpage. basalt: mineralogy. surficial alluvium: thickness, distribution, moisture content, specific gravity, bulk density, specific retention, porosity, specific yield, hydraulic conductivity, grain size distribution, water quality: specific conductance, gross gamma radioactivity, tritium, Sr-90, sodium, chromium. perched water: TRA areal extent, altitude, well hydrograph.

Morris, D.A., G.M. Hogenson, W.E. Teasdale, and E. Shuter, 1963. Hydrology of Waste Disposal National Reactor Testing Station Idaho Annual Progress Report 1962; U.S. Geological Survey, IDO-22044-USGS, 99 pages.

Abstract or Summary:

Past investigations of the hydrology of the National Reactor Testing Station (NRTS) concentrated principally on detailed investigations of small areas within the station. While such studies will continue future investigations will emphasize the large-scale view and will extend the present detailed knowledge of the small areas to the entire site. The focus of this year's work was to determine the effect of underground disposal of liquid radioactive waste upon the regional ground water source. This required a knowledge of the travel path, velocity and volume of lost water, the nature and volume of the waste and the extent to which ion exchange, decay and dispersion reduce any hazard from the waste. Tritium artificially induced into the ground water has been used to determine the direction and velocity of the ground water flow and the amount of dispersion or dilution that takes place. Naturally occurring tritium by its known rate of decay has been used to determine the age of ground water. Rates of ground water movement based on "first arrival" ranged from 19 to 140 feet per day and averaged 60 feet per day. However, analysis of the tracer by center of mass, or maximum tritium concentration, indicate average ground water velocity is 10 to 13 feet per day. Tritium from waste disposal is traveling laterally beneath the NRTS and is discernable in water from several supply wells notably that at Central Facilities. A serious problem in the interpretation of tritium data is the extreme inconsistency of results of tritium analyses made by different laboratories. The MTR-ETR pond was constructed for the purpose of disposing of radioactive liquid waste by permitting the water to infiltrate into the ground. This procedure supposes that the waste eventually will reach the regional ground water resource. A continuing study of the hydrology of the pond system is being conducted to determine whether a potential hazard exists in this disposal method and to suggest a means of evaluating disposal systems to forestall the likelihood of any hazard developing. From the upper perched ground water body, the waste percolates downward until it reaches perching layers in the basalt from where it spreads laterally for substantial distances before moving slowly downward toward the regional water table. These perching layers are regarded as being beneficial as they delay the downward movement and provide for dispersion, dilution, attenuation and in time for radioactive decay. Recharge to the Snake Plain / quifer by underflow from tributary areas is by far the most significant source of ground water replenishment. The principal sources of this recharge are from the Little Lost River and Birch Creek Valley and the Mud Lake Basin. Geological Survey is conducting a sitewide program of water level measurement in selected wells to define any regional trends in water level changes to observe changes that may result from operations at NRTS. Other U.S. Geological Survey offices are conducting studies that are supplementary to the hydrologic studies at the NRTS.

Data:

water level: changes, regional trends, hydrologic studies, well hydrograph, infiltration rate, barometric efficiency. surficial sediment: generalized stratigraphy, lithologic log, gamma-ray log, neutron log, grain size distribution, specific gravity, bulk density, moisture equivalent, specific retention, porosity, specific yield, hydraulic conductivity. water quality: radioactivity, distribution, tritium, specific conductance, gross gamma radioactivity. perched water: velocity, TRA areal extent, altitude, ICPP. basalt: surface altitude. regional ground water: velocity, altitude.

Morris, D.A., W.E. Teasdale, G.H. Chase, G.M. Hogenson, J.T. Barraclough, D.A. Ralston, R.G. Jensen, and E. Shuter, 1964. Hydrology of Subsurface Waste Disposal National Reactor Testing Station Idaho Annual Progress Report 1963; U.S. Geological Survey, IDO-22046-USGS, 97 pages.

Abstract or Summary:

The research effort in hydrology at the NRTS has recognized that the rock system underlying the NRTS constitutes a very complex flow system when viewed at one point. The microscopic approach of recent studies has now given way to a large scale or broad approach because the heterogeneous nature of the system makes this more statistical approach necessary. The emphasis is consequently being directed towards investigation of the regional geohydrology of the NRTS. A step in this direction has been made with the preliminary study of the physical and chemical quality of ground water throughout the NRTS. This report indicates additional progress in the interpretation of the geology of the area on the basis of preliminary gravity and magnetic surveys, and sketches the progress made in the study of the hydrology of waste disposal. Results from microscopic studies of the geohydrology of waste disposal at the NRF and ICPP are presented along with data from the sitewide drilling program.

Data:

water quality: specific conductance, sodium, gross gamma radioactivity, temperature, color, pH, total dissolved solids, calcium, magnesium, sodium, potassium, bicarbonate, carbonate, sulfate, chloride, fluoride, silica, iron, hardness, chromium, liquid waste: radioactivity, volume, Sr-90, Co-60, Co-58, Cs-134, Cs-137, I-129, I-131, tritium, gross gamma radioactivity. basalt: ICPP, NRF, altitude. alluvial sediment: ICPP, NRF, generalized stratigraphy, gamma-ray log, gross gamma radioactivity, moisture profile, LOFT, SET, grain size distribution, specific gravity, bulk density, moisture equivalent, specific retention, porosity, specific yield, hydraulic conductivity, thickness. perched water: TRA, ICPP, NRF, areal extent, altitude

Mudra, P.J., and B.L. Schmalz, 1965. An Appraisal of Gaseous Waste Disposal in the Lithosphere at the National Reactor Testing Station, Idaho; U.S. Atomic Energy Commission, Idaho Operations Office, IDO-12024, 137 pages.

Abstract or Summary:

A series of gas injection field tests were performed at the National Reactor Testing Station, Idaho, during the summer of 1964 to determine the feasibility of discharging radioactive gaseous waste to the lithosphere. Specific objectives included determination of the (a) storage capacity of the lithosphere, (b) direction of velocity of migration of injected gas, (c) dilution and dispersion effects on the initial concentration of the injected gas, and (d) pressures required for injection. A cost estimate used in this concept under hypothetical circumstances was also developed. Helium was used as a tracer gas to identify approximately 33,000,000 standard cubic feet of air into porous zones, both above and below the regional water table within the basalts underlying the station and into the unconsolidated sandy regolith materials. The maximum depth of injection was 400 feet below land surface. A mean pressure of 15 psig was required to maintain the injection rate of 1,000 cubic feet per minute into the unsaturated basalt zones. Observations indicated that no finite geological reservoir existed in the subsurface and that the regolith materials offered the most restrictive barrier to vertical movement. Although injected gas could eventually arrive at land surface, the amount of dispersion and dilution observed indicates that lithospheric gas disposal is feasible at the NRTS for single injection volumes up to 6,000,000 standard cubic feet. The cost for a lithospheric disposal system is estimated at the maximum of \$250,000.

Data:

Borehole, geophysical logs, lithologic log, particle size distribution sediments.

Nace, R.L., 1952. Water Supply and Waste Disposal at Proposed ANPR Site National Reactor Testing Station, Idaho; U.S. Geological Survey, IDO-22021-USGS, 15 pages.

Abstract or Summary:

Summary of ground water availability and waste disposal options at the ANPR Site.
The analysis rules out surface ponds for waste disposal.

Data:

condensed drillers log

Nace, R.L., 1955. Water Supply and Waste Disposal for Proposed Engineering Test Reactor, Large Ship Reactor, and Organic-Moderator Reactor Experiment, National Reactor Testing Station, Idaho; U.S. Geological Survey, IDO-22031-USGS, 18 pages.

Abstract or Summary:

Discusses water supply and waste disposal requirements at the reactor sites. Recommendations for water supply and waste disposal are presented. Water quality from existing well are reportedly held by the U.S. Atomic Energy Commission.

Data:

none

Nace, R.L. and J.T. Barraclough, 1952. Groundwater Recharge from the Big Lost River Below Arco, Idaho; U.S. Geological Survey, IDO-22016-USGS, 31 pages.

Abstract or Summary:

The Big Lost River rises from tributaries on the northeast slopes of the Pioneer and Boulder mountains. The main stream flows northeastward to the vicinity of Chilly, where it turns southeastward and follows an elongated valley to the vicinity of Arco. Near Arco the river debouches into a broad alluvial flood plain, from which it passes southeastward into the basalt plain. Near Pioneer station on the Union Pacific railroad the river emerges from a narrow, shallow, basalt-walled canyon onto a gravel floodplain and flows northeastward to northward through the NRTS. The river channel ends in the northern part of the NRTS, where the river is intermittent. Unseasonably high runoff in the Big Lost River during the latter half of 1951 permitted a special study that was intended to elicit data on rates of seepage loss. Useful information about groundwater increments and seepage losses from the river is summarized in this report. Relevant data concern the volume and rate of flow of the river, seepage losses (infiltration rates) in various segments and reaches, channel form and capacity, and fluctuations of the water table (from recharge).

Data:

precipitation, Big Lost River discharge, infiltration, recharge. streamflow gage: location, discharges.

Nace, R.L., M., Deutsch and P.T. Voegeli, 1956. Geography, Geology, and Water Resources of the National Reactor Testing Station, Idaho Part 2. Geography and Geology; U.S. Geological Survey, IDO-22033-USGS, 285 pages.

Abstract or Summary:

Geologic factors in the physical environment of the NRTS control the amount and availability of the water supply, the methods and efficiency of obtaining water, and the behavior of waste materials that are disposed on the ground or beneath the land surface. These factors also effect construction and operation. For those reasons, areal and subsurface geologic study and mapping were a major part of investigations on the NRTS.

Data:

soil temperature, moisture content profile, pumpage, generalized lithology, dragline test pit lithologic log, drillers log. basalt: mineralogy, calcic plagioclase, augite, titanaugite, olivine, magnetite, ilmenite, compressive strength. alluvial sediments: grain size distribution, mineralogy, silica, iron oxide, aluminum, titanium, calcium, magnesium, sodium, potassium, boron, nitrogen, phosphorus, chloride, carbonate, bicarbonate, sulfate, pH, lime, magnesia, carbon dioxide, clay mineralogy, montmorillonite, hydrous mica, kaolinite, quartz, calcite, feldspar, dolomite, cation exchange capacity, bearing capacity, compaction, atterberg limits.

Nace, R.L., J.H. Jones, P.T. Voegeli and M. Deutsch, 1951. Geology and Ground Water in the Central Construction Area, Reactor Testing Station, Idaho; U.S. Geological Survey, IDO-22004-USGS, 64 pages.

Abstract or Summary:

Summary of the principal results of a detailed study of the ground water and geology of the central construction and facilities area (CFA) on the NRTS. The investigations emphasize evaluation, development, conservation, and protection of ground water resources. The geologic information gathered is useful in engineering planning and design, well construction, liquid waste disposal, drainage, road construction, and excavation. Emphasis is on the rocks, soils and sediments present at the land surface, their types, surficial distribution, and probable subsurface extensions.

Data:

Grain size distribution, near surface stratigraphy, subsurface basalt contour, fence diagram, discharge-drawdown. water quality: pH, specific conductance, temperature, silica, iron, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate chloride, fluoride, nitrate, boron, manganese, turbidity, total dissolved solids, hardness. condensed drillers logs.

Nace, R.L. and P.T. Voegeli, 1951. Geology and Ground Water at Site 1 and an Adjacent Area to the East, Reactor Testing Station, Idaho; U.S. Geological Survey, IDO-22003-USGS, 18 pages.

Abstract or Summary:

Summary of the principal results of a study of the ground water and geology of Site 1 (EBR) and an adjoining area of four and one-half sections to the east on the NRTS. The investigations emphasize development, protection and utilization of ground water, location and arrangement of reactor plants and facilities, and management of liquid waste disposal. The report describes the types of rocks, soils, and sediments present at the land surface, their surficial distribution, and their probable subsurface extensions.

Data:

grain size distribution, discharge-drawdown, modified drillers log, liquid waste: facilities description

Nichols, W.D., 1987. Geohydrology of the Unsaturated Zone at the Burial Site for Low-Level Radioactive Waste Near Beatty, Nye County, Nevada. U.S. Geological Survey Water-Supply Paper 2312; U.S. Geological Survey, 57 pages.

Abstract or Summary:

Low-level radioactive solid waste has been buried in trenches at a site near Beatty, Nevada, since 1962. In 1976, as part of a national program, the U.S. Geological Survey began a study of the geohydrology of the waste burial site to provide a basis for estimating the potential for radionuclide migration in the unsaturated zone beneath the waste burial trenches. The waste burial site is in the northern Amargosa Desert, about 170 kilometers northwest of Las Vegas, Nevada. The site is underlain by poorly stratified deposits of gravelly or silty sand and sandy gravel and thick beds of clay sediments to a total thickness of about 175 meters with an unsaturated zone of about 85 meters. Evaporation studies over a two year period were used to calibrate a numerical procedure for analyzing long-term precipitation data and estimating annual water budgets during the 15 year period 1962-76. This analysis (1) demonstrated that a potential exists for deep percolation (greater than two meters) despite high annual evaporation demands and (2) provided predictions of the time of year and the antecedent conditions that enhance the probability of deep percolation. Soil moisture profiles obtained monthly over an 18 month period demonstrate that deep percolation does occur. Soil moisture conditions antecedent to an observed deep percolation event and the time of year when the percolation occurred, support the interpretations based on long-term meteorological records. Calculation of downward moisture movement through the waste trench backfill material on the basis of simplified assumptions, suggests that moisture could have penetrated as much as six meters below the land surface from 1963, when the oldest trenches were closed, to 1980, but that the moisture requirement for such penetration far exceeded the amount of moisture actually available. Steady state downward movement of moisture at depths greater than 10 meters and beneath the waste burial trenches would be on the order of four centimeters per 1,000 years assuming a steady flux rate of $10E-5$ centimeters per day.

Data:

Capillary pressure, grain size distribution, hydraulic conductivity, moisture retention, moisture content, soil moisture profile, surficial sediment.

Northern Engineering and Testing, Inc., 1988. Final Report Geohydrologic Investigation of Industrial Waste Pond at Argonne National Laboratories West, Idaho Falls, Idaho; Northern Engineering and Testing, Inc., NE497.HG, 45 pages.

Abstract or Summary:

The purpose of this report is to summarize and present the findings of the ground water investigation and associated water quality analyses. The primary objectives of this investigation were to characterize the geology and hydrogeology of the area adjacent to the industrial wastewater pond and document the water quality of the uppermost aquifer. This information is necessary so that ANL-W can include same as part of its closure plan for the industrial wastewater pond and associated discharge ditches. The targeted sedimentary interbed occurring at an approximate depth of 40 to 50 feet below the ground surface is not aerially extensive and is noticeably absent west of the industrial waste quality. Several factors combine to account for the absence of a perched water body: (1) a discharge volume of 23.7 to 31.7 million gallons per year from the ANL-W facility to the industrial waste pond is relatively small as compared with other facilities on the INEL discharging waste water; (2) the grain size of sedimentary interbeds is not sufficiently fine to inhibit vertical flow; and (3) the interbeds underlying the pond are aerially nonextensive and are relatively thin, 6.5 feet as compared to other areas on the INEL where perched aquifers are present. Analytical results of water samples from the Industrial Waste Pond and well ANL-M5 imply that the shallow ground water is derived from seepage of the industrial waste pond water. Sediment samples collected from the industrial waste pond in the estuary do not contain sufficient concentration of contaminants to exhibit characteristic EP toxicity and therefore cannot be classified as a hazardous waste.

Data:

Borehole, geophysical logs, lithologic log, water quality, temperature, specific conductance, pH, Eh, dissolved oxygen, arsenic barium, zinc, iron, manganese.

Norton, T.J., 1990. Development of Perched Water Zones Associated with the Idaho Chemical Processing Plants Unlined Aqueous Waste Infiltration Ponds; Washington State University.

Abstract or Summary:

Since February, 1984, the continued discharge of over 1.5 million gallons a day of chemical radioactive waste from the Idaho Chemical Processing Plant has led to the development of several perched water zones. Using neutron logs taken in three consecutive years for two wells in close proximity to the infiltration ponds, development of perched water zones at 30 to 100, 150 and 330 feet below the ground surface can be delineated. Three distinct sets of circumstances related to changes in vertical hydraulic conductivity are associated in the development of perched water in the geologic profile beneath the infiltration ponds: (1) a perched water zone developed at the surficial alluvium-basalt interface in response to a decreased cross-sectional area available for flow combined with the effects of sediments filling fractures; (2) wastewater tends to accumulate and form a perched water body when the flow of wastewater downward through fractures in the basalt is impeded by a sediment interbed with a lower hydraulic conductivity; and (3) perched water zones also develop in thicker basalt groups between layers where changes in hydraulic conductivities are associated with bake zones and/or fracture occlusion. MODFLOW, a three-dimensional finite difference flow model (McDonald and Harbaugh 1984) was used to simulate the development of the perched water zone that occurs at the 110 foot sediment interbed. Steady state simulations were conducted using a wastewater recharge rate of .805 feet per day per square foot and hydraulic conductivities of 10, 28.9 and .02 feet per day for the surficial alluvium, basalt and sediment interbeds respectively. The ground water budget computed by the model was off less than 1.5%. Simulated maximum thickness and total areal extent correlated well with field data. However, there was a poor correlation between head simulated by the model and that which occurred in two of six observation wells, which reflects the model's inability to accurately depict the real geological complexity and steep hydraulic gradient present.

Data:

geophysical logs, neutron, logs, hydraulic conductivity, borehole, lithologic logs, gamma logs.

Olmsted, F.H., 1962. Chemical and Physical Character of Ground Water in the National Reactor Testing Station, Idaho; U.S. Geological Survey, IDO-22043-USGS, 125 pages.

Abstract or Summary:

This report describes the chemical and physical properties of the ground water beneath the NRTS. The chemical properties described are chiefly concentrations and proportions of dissolved constituents. The physical properties include temperature, specific conductance, density, and viscosity.

Data:

recharge. basalt: mineralogy, plagioclase, augite, titanite, olivine, magnetite, ilmenite. water quality: temperature, color, pH, specific conductance, total dissolved solids, calcium, magnesium, sodium, potassium, bicarbonate, carbonate, sulfate, chloride, nitrate, fluoride, silica, iron, hardness. temperature profiles, specific conductance profiles, temperature distribution

Orr, B.R. and L.D. Cecil, 1991. Hydrologic Conditions and Distribution of Selected Chemical Constituents in Water, Snake River Plain Aquifer, Idaho National Engineering Laboratory, Idaho 1986 to 1988; U.S. Geological Survey, DOE/ID-22096, 56 pages.

Abstract or Summary:

This report presents an analysis of water level and water quality data collected from the Snake River Plain aquifer during 1986-88 as part of the continuing hydrogeologic investigation at the INEL. This report describes the distribution and concentration of selected radioactive and chemical constituents in ground water from disposal of wastes at the INEL. Detectable concentrations of radioactive and chemical waste constituents in water from the Snake River Plain aquifer at INEL decreased during 1986-88. Decreased radionuclide concentrations are attributed to reduced rates of radioactive waste disposal, and to sorption processes, radioactive decay, dilution from recharge, and changes in waste disposal practices.

Data:

Big Lost River recharge, regional water table, liquid waste: type, volume, radioactivity, source, solid waste: type, volume, radioactivity, water quality: concentration, distribution, tritium, Sr-90, Co-60, Cs-137, Pu-238, Pu-239, Pu-240, Am-241, total chromium, sodium, chloride, nitrate, lead, mercury, specific conductance, temperature, pH.

Osloond, J.H., 1970. **Waste Disposal Data for the National Reactor Testing Station Idaho;** U.S. Atomic Energy Commission, Idaho Operations Office, IDO-12074, 27 pages.

Abstract or Summary:

A total liquid waste volume of 2.82×10^9 liters and a gross activity quantity of 4,180 curies were discharged to the NRTS lithosphere during 1969. About 72% was composed of radionuclides having a half-life of less than 30 days. Tritium comprised 21%. The total radioactivity released to the atmosphere during 1969 was 76,400 curies. Ninety-eight percent in the form of noble gases. The noble gas radionuclides identified were Ar-41, Kr-88-89, and Xe-137-138 which have half-lives of two hours or less. During 1969 a total of 972,000 curies in 410,000 cubic feet of solid waste were deposited in the NRTS burial ground. Approximately 242,000 cubic feet contaminated with 36,000 curies originated at the Rocky Flats establishment. This waste was contaminated with plutonium isotopes and Am-241. The specific activity was about 0.2 curies per cubic foot. The primary contaminant in the on-site generated waste was Co-60. The specific activity of the on-site waste was approximately 5.6 curies per cubic foot. The nonradioactive liquid waste disposed of at the NRTS originated from cooling towers, equipment coolants, laboratory chemical waste, water treatment plants, and sanitary systems. Secondary treatment plants, lagoons and septic tank systems are used for sanitary wastes. The wastes from cooling towers, laboratories, and water demineralizing units are discharged to seepage ponds and disposal wells. An estimated 1.1×10^6 liters per day of sanitary waste flow to seepage locations and from treatment plants and septic systems. The total volume of cooling wastes discharged is approximately 1.5×10^8 liters per month. The nonradioactive waste discharged to the atmosphere consisted of gases and particulates from the chemical processing plant, area heating plants and solid waste incinerators.

Data:

liquid waste: gross radioactivity, volume, source, concentration, Sr-89, Sr-90, I-131, Cs-137, Ce-141, Ce-144, Cr-51, Co-60, Ru-103, Ru-106, Rh-106, BaLa-140, tritium, Zr-Nb-95 settleable solids, BOD, chlorination residual, mean discharge. airborne waste: gross radioactivity, volume, Ar-41, Xe-137, Xe-138, Kr-88, Kr-89, Ru-106, Rh-106, Ce-141, Ce-144, Zr-95, Nb-95, Cs-134, Cs-137, Sr-90, I-131, I-133, tritium. solid waste: gross radioactivity, volume, container type, U-235, U-238, Pu-238, Pu-239/240, Pu-241, Am-241. plan of burial waste ground (RWMC), plan of EBR-II storage area and containment.

Paige, B.E., F.A. Siedenstrang and M.R. Niccum, 1972. Evaluation of Hazards and Corrosion of Buried Waste Lines in NRTS Soils; Allied Chemical Corporation, Idaho Chemical Programs - Operations Office, National Reactor Testing Station, Idaho Falls, Idaho, ICP-1013, 240 pages.

Abstract or Summary:

The purpose of this study was to locate and categorize buried waste lines and to establish corrosion control and monitoring program for potentially hazardous underground piping systems. Primary attention was given to the study of lines transferring radioactive waste. Evaluation of the degree of hazard from waste lines was based on composition and activity of the waste handled. The potential for contamination of the environment was based on the construction of lines, frequency of use, and existing methods of monitoring the lines. Because external corrosion can be significant on buried lines, the NRTS soils were reviewed for soil profile, hydraulic conductivity, and moisture content. Three distinct soil types are located at different NRTS areas: CPP-TRA, TAN, and ARA-SPERT-CFA. By relating the chemical and physical properties determined on soil samples from these sites to other soils examined by the National Bureau of Standards, the corrosivity of soils at the NRTS were evaluated. Wet soils are definitely corrosive to carbon steel in all three soils types. Field moisture conditions at CPP-TRA may result in only mildly corrosive conditions, while at TAN, the soil can be expected to be more corrosive because it retains more moisture. Detection of leaks after they have occurred is less desirable than prevention of leaks by separating pipes from the soil in encasements and tunnels or by cathodic protection. Estimates of infiltration of liquids in NRTS soils indicate that most waste line leaks will not be detected as surface moisture at CPP and TRA, but probably will be detected at TAN: soil profiles make the probability of detection variable at CFA-ARA-SPERT.

Data:

surficial sediment: resistivity, moisture equivalent, pH, carbonate, bicarbonate, chloride, sulfate, hardness, generalized stratigraphy, grain size distribution, hydraulic conductivity, infiltration rate

Peckham, A.E., 1959. Investigation of Underground Waste Disposal, Chemical Processing Plant Area, National Reactor Testing Station, Idaho; U.S. Geological Survey, IDO-22039-USGS, 35 pages.

Abstract or Summary:

This interim report describes the progress made in observations of the rate and direction of movement of liquid waste discharged through the disposal well at the ICPP. The report contains tabulated data and tentative conclusions based on explorations through March 1958.

Data:

transmissivity, storage coefficient, velocity.

Pigott, W., 1989. Monitoring Analysis and Test Plan TRA 36 ETR Cooling Tower; EG&G Idaho, Inc., EGG-ER-8544, 80 pages.

Abstract or Summary:

This report was written to comply with the consent order/compliance agreement (COCA) between the Environmental Protection Agency Region 10 and the Department of Energy Idaho Operations Office. Further, this report states the objectives of the proposed test plan, gives a brief history of the area, addresses the geologic conditions at the INEL and the proposed sampling and analysis plan as well as the proposed completion schedule. The engineer test reactor cooling tower TRA 36 is located in the Test Reactor Area (TRA). The cooling tower was dismantled in 1981, however, the TRA 36 area has been identified as a solid waste management unit. Chromates were used for corrosion control in the water that circulated through the cooling tower from 1958-1972. Consequently, it is possible that vapors containing chromates were carried via the prevailing wind drift and deposited on the ground in the vicinity of the cooling tower. Chromium has a tendency to become sorbed and entrapped in the soil. Therefore, it is possible, but not likely, that chromium is present in the soil. On December 19, 1988, EG&G Idaho submitted a report entitled "Potential Release Information for ETR Cooling Tower, TRA 36 and MTF Cooling Tower TRA 39. This monitoring analysis test plan contains background data, quality assurance/quality control of parameters and proposed sampling and analysis activities, and this plan is intended to supplement the information previously submitted.

Data:

Cation exchange capacity, grain size distribution.

Pittman, J.R., 1989. Hydrological and Meteorological Data for an Unsaturated Zone Study near the Radioactive Waste Management Complex, Idaho National Engineering Laboratory, Idaho - 1985-86; U.S. Geological Survey, DOE/ID-22079, 175 pages.

Abstract or Summary:

Presents the progress of a study to obtain a reliable estimate of the amount of water that infiltrates the surficial sediment and eventually recharges the aquifer by quantifying ET rates, soil moisture content and variability, soil-moisture flux, hydraulic conductivities, soil moisture velocities, and soil temperatures. The data are to be used to calibrate a numerical model of the unsaturated zone to predict the migration of radionuclides in the subsurface. Two test trenches were installed in the surficial sediment adjacent to the RWMC burial ground to collect hydrologic data from undisturbed and disturbed soil. During 1985 and 1986, soil temperature and soil water potential measurements were taken every 12 hours from 30 sensors placed at selected depths from 0.5 to 6.1 m. Weekly soil moisture content measurements were collected in 9 neutron probe access holes using a neutron moisture depth gage. Wind speed, wind direction, relative humidity, and air temperature data were averaged every 6 hours. Solar radiation and precipitation were totaled over the 6-hour intervals.

Data:

test trench instrumentation, soil temperature, capillary pressure, moisture content, soil moisture profile, bulk density, moisture retention, total solar radiation, reflected solar radiation, wind speed, wind direction, relative humidity, air temperature, precipitation.

Pittman, J.R., R.G. Jensen and P.R. Fischer, 1988. Hydrologic Conditions at the Idaho National Engineering Laboratory 1982 to 1985; U.S. Geological Survey, DOE/ID-22078, 73 pages.

Abstract or Summary:

Aqueous chemical and radioactive wastes discharged since 1952 to unlined ponds and wells at the INEL have affected water quality in perched ground water zones and in the Snake River Plain aquifer. Routine waste water disposal changed from a deep injection well to ponds at the ICPP in 1984. During 1982-85, tritium concentrations increased in perched ground water zones under disposal ponds, but Co-60 concentrations decreased. During 1982-85, tritium concentrations in water in the Snake River Plain aquifer decreased as much as 80 pCi/ml near the ICPP. Tritium was detected in ground water near the southern boundary of the INEL 9 miles south of the ICPP and TRA. Sr-90 concentrations in ground water generally were smaller than 1981 concentrations. Sodium and chloride concentrations generally decreased during 1982-85. Nitrate concentrations increased near TRA and NRF and decreased near the ICPP.

Data:

Big Lost River discharge, regional water table, well hydrograph. liquid waste: radioactivity, volume, tritium, sulfate, sodium, Sr-90, chloride, Cr-51, Co-60, Cs-137, Pu-238, Pu-239, Pu-240. perched water: areal extent, altitude, tritium, Co-60, sodium, chromium, chloride, sulfate, nitrate, specific conductance, temperature. water quality: distribution, tritium, Sr-90, sodium, chloride, nitrate, lead, mercury, specific conductance.

Rasco, R.D., and M.J. Spry, 1991. Informal Report -- Closure Plan for the Central Facilities Area French Drain (COCA Unit CFA-07); EG&G Idaho, Inc., EGG-WM-9494, 65 pages.

Abstract or Summary:

This document describes the proposed plans for closure of the Central Facilities Area French Drain (CFA-07) in accordance with the Consent Order and Compliance Agreement. The location and physical characteristics of the site are described. The site has not been characterized in regard to the presence and/or extent of hazardous waste. Characterization activities are described. The following proposed closure methods are described: clean closure by waste removal, clean closure using health-based exposure limits, and closure as a landfill. A tentative schedule for closure activities is presented.

Data:

aquifer: depth, thickness. ecology: flora, fauna. transmissivity, storativity, recharge: Snake River. regional water table, small mammals, vegetation, hydraulic conductivity, surficial sediments: thickness. fence diagram, sedimentary interbed: thickness, altitude. basalt: thickness, altitude. well: depth, location.

Rawson, S.A. and J.M. Hubbell, 1989. Geochemical Controls on the Composition of Soil Pore Waters Beneath a Mixed Waste Disposal Site in the Unsaturated Zone; Idaho National Engineering Laboratory, 6 pages.

Abstract or Summary:

Soil pore waters are collected routinely to monitor a thick unsaturated zone that separates a mixed waste disposal site containing transuranic and low level radioactive waste from the Snake River Plain aquifer. The chemistry of the soil pore waters has been studied to evaluate the possible control on the water composition by mineral equilibria and determine the extent, if any, of migration of radionuclides from the disposal site. Geochemical codes were used to perform speciation calculations for the waters. The results of speciation calculations suggest that the installation of the lysimeters affects the observed silica contents of the soil pore waters. The results also establish which chemical parameters are controlled by secondary mineral precipitation.

Data:

Surficial sediments, pH, temperature, specific conductance, dissolved oxygen, potassium, silica, sodium, HCO_3 , carbonate.

Rehak, E.M., 1989. Statistical Analysis of TRA Warm Waste Pond Chemical Data; EG&G Idaho, Inc., EGG-SARE-8712, 25 pages.

Abstract or Summary:

This report contains the results of the statistical analysis of the chemical data from the Remedial Investigation sampling performed in the TRA Warm Waste Pond in May, June, and July of 1988. The objectives of this investigation were to identify the principle locations of hazardous constituents identified in the Preliminary Investigation and determine the spatial distribution of these contaminants. The contaminants identified in the preliminary investigation include six organic analytes and thirteen inorganic analytes. The TRA Warm Waste Pond sampling is comprised of three separate cells identified by the year in which they were excavated, 1952, 1957, and 1964. In order to assess the extent of the contamination, sampling was done across the three ponds. The locations of the sampling sites were determined by using systematic sampling on an unaligned grid. Grid size is dependent on the area to be covered and the number of sampling locations selected. Six sites were selected to be sampled in each of the ponds. The ponds were sampled at two foot intervals from the surface down to ten feet.

Data:

borehole: location, sediment, acetone, acrylonitrile, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, di-n-octylphthalate, pentachlorophenol, arsenic, beryllium, cadmium, chromium, copper, cyanide, hexavalent chromium, mercury, silver, sulfide, TOC, zinc.

Rightmire, C.T., 1984. Description and Hydrogeologic Implications of Cored Sedimentary Material from the 1975 Drilling Program at the Radioactive Waste Management Complex, Idaho; U.S. Geological Survey, DOE/ID-22067, 33 pages.

Abstract or Summary:

Samples of sedimentary material from interbeds between basalt flows and from fractures in the flows, from beneath the RWMC were analyzed for (1) particle size distribution, (2) bulk mineralogy, (3) clay mineralogy, (4) cation exchange capacity, and (5) carbonate content. Thin sections of selected sedimentary interbed material were made for petrographic examination. The results of these analyses are interpreted as a first step in characterizing the paths and rates of movement of radionuclides transported by infiltrating water. Preliminary interpretations indicate that: (1) it may be possible to distinguish the various sedimentary interbeds on the basis of their mineralogy, (2) the presence of carbonate horizons in sedimentary interbeds may be utilized to approximate the time of exposure and the climate while the surface was exposed, and (3) the type and orientation of fracture-filling material may be utilized to determine the mechanism by which fractures were filled.

Data:

grain size distribution, specific gravity, bulk mineralogy, quartz, potassium feldspar, plagioclase, calcite, pyroxene, clay content, chlorite, illite, montmorillonite, kaolinite, cation exchange capacity, carbonate content, lithologic log, gamma-gamma log, gamma-ray log, neutron log.

Rightmire, C.T. and B.D. Lewis, 1987. Geologic Data Collected and Analytical Procedures Used During a Geochemical Investigation of the Unsaturated Zone, Radioactive Waste Management Complex Idaho National Engineering Laboratory, Idaho; U.S. Geological Survey, DOE/ID-22072, 83 pages.

Abstract or Summary:

Describes the cored material and subpit sedimentary samples, and documents the sample preparation and analytical techniques used to characterize the hydrologic and geochemical environment of the unsaturated zone at the RWMC. This characterization is needed to develop a conceptual model of the hydrogeochemical environment of the shallow unsaturated zone, and to determine how changes in that environment may influence the mobility and migration of waste radionuclides buried in pits and trenches at the RWMC between the early 1950s and early 1970s. Visual and optical inspections of cored material collected from eight wells drilled during a 1976-1977 drilling program, along with subpit sedimentary samples, provided the needed hydrogeologic data.

Data:

core descriptions, thin-section analyses, x-ray diffraction.

Rightmire, C.T., and B.D. Lewis, 1987. Hydrogeology and Geochemistry of the Unsaturated Zone, Radioactive Waste Management Complex (RWMC), Idaho National Engineering Laboratory, Idaho, U.S. Geological Survey, Water-Resources Investigations Report 87-4198; U.S. Geological Survey, DOE/ID-22073, 89 pages.

Abstract or Summary:

To assess the potential migration of low-level radioactive waste in the shallow subsurface, it is necessary to understand the chemical interactions that occur between solids, liquids, and gases in the unsaturated zone. For this purpose, a study on the geochemistry of the unsaturated zone at the Radioactive Waste Management Complex (RWMC) was done. Stable isotope and chemical data suggest that the perched water beneath the RWMC is not due to vertical infiltration through the ground surface at the RWMC, but is due to lateral flow of water that infiltrated through the diversion ponds. It is hypothesized that the water accumulates as a perched mound on the thick, laterally continuous sedimentary interbed at a depth of 73 meters (m) and then moves about 1.5 kilometers to the northeast beneath the RWMC. Infiltrating water can move clay, silt, and sand downward through sedimentary material and open fractures, at least to the interbed at a depth of 73 m. Oxygen isotope exchange and clay mineral alteration caused by extruded lava have been observed in the upper 0.86 m of the sedimentary interbed at a depth of 34 m and in the upper 2.65 m of the sedimentary interbed at a depth of 73 m. An examination of the sediment-basalt interrelation shows that the flows overlying the interbed at a depth of 73 m are substantially thicker than the flows overlying the interbed at a depth of 34 m (16 to 23 m compared to 6 to 10 m). Therefore, a greater influence of residual heat from cooling of lava flows after emplacement on the sedimentary unit that underlie the thicker flows, and thus greater alteration, may be expected. Sedimentary material at the RWMC shows isotopic and soils evidence of at least two major climatic changes within the last 200,000 years.

Data:

surficial sediment: thickness, altitude, grain size distribution, mineralogy, quartz, potassium feldspar, plagioclase, calcite, pyroxene, stable isotopes, clay mineralogy, chlorite, illite, smectite, kaolinite, cation exchange capacity, carbonate content, x-ray diffraction. sedimentary interbed: thickness, altitude, grain size distribution, stratigraphy, bulk mineralogy, quartz, plagioclase, clinopyroxene, potassium feldspar, silicates, calcite, dolomite, olivine, iron, clay mineralogy, illite, smectite, kaolinite, carbonate content, cation exchange capacity, x-ray diffraction, stable isotope. basalt: thickness, altitude. discharge: Big Lost River. aquifer: thickness. velocity: ground water. regional water table, perched ground water: altitude, aluminum, iron, manganese, calcium, magnesium, potassium, sodium, bicarbonate, carbonate, chloride, fluorine, hydroxide, alkalinity, sulfate, phosphate, bromide, boron, strontium, silica, pH, temp, stable isotopes. porosity, hydraulic conductivity, infiltration, recharge precipitation: concentration, calcium, magnesium, potassium, sodium, bicarbonate, carbonate, chloride, fluorine, hydroxide, sulfate, silica, pH, specific conductance, deuterium, oxygen-18. water quality: calcium, magnesium, potassium, sodium, bicarbonate, carbonate, chloride, fluorine, hydroxide, sulfate, silica, pH, specific conductance, deuterium, oxygen-18. soil gases: carbon dioxide, nitrogen, oxygen, argon, deuterium, oxygen-18.

Robertson, J.B., 1969. Behavior of Xenon-133 Gas after Injection Underground: Molecular Diffusion, Materials Balance, and Barometric Pressure Effects; U.S. Geological Survey, IDO-22051, 37 pages.

Abstract or Summary:

Nine hundred and eighty-seven curies of radioactive Xenon-133 gas were injected rapidly under pressure to 1.5 to 1.65 psig with one million cubic feet of air into permeable basalt strata. A capping layer of fine-grained playa sediments confined the gas underground. Underground distribution patterns after injection pressures had dissipated were evaluated by materials-balance analysis. The results indicated that most of the Xenon-133 gas remained underground and decayed radioactively. Molecular diffusion rates of Xenon-133 from the ground were estimated using a simplified numerical model. The estimated diffusion rates indicated a total diffusion loss of 0.37 curies for the total area over the 26-day observation period. The effects of barometric pressure on the vertical flow rates of Xenon-133 were estimated for the maximum possible conditions.

Data:

gas injection test: concentration contours Xenon-133, porosity, effective porosity, diffusion coefficient, moisture content, diffusion rate, permeability, barometric flux rate.

Robertson, J.B., 1974. Digital Modeling of Radioactive and Chemical Waste Transport in the Snake River Plain Aquifer at the National Reactor Testing Station, Idaho; U.S. Geological Survey, IDO-22054, 41 pages.

Abstract or Summary:

Digital modeling techniques were applied to the analysis of the complex waste transport system by utilizing a numerical solution of the coupled equations of ground water motion and mass transport. The model includes the effects of convective transport, flow divergence, two-dimensional hydrologic dispersion, radioactive decay, and reversible linear sorption. The hydraulic phase of the model uses the iterative, alternating-direction, implicit finite difference scheme to solve the ground water flow equations, while the waste transport phase uses a modified method of characteristics to solve the solute transport equations simulated in the model. The modeling results indicate that hydrologic dispersion is a much more significant influence than previously suggested by earlier studies. The model is used to estimate future waste migration patterns for varied assumed hydrological and waste conditions through the year 2000. The hydraulic effects of recharge from the Big Lost River have an important influence on the simulated future migration patterns.

Data:

liquid waste: volume, radioactivity, source, tritium, Sr-90, Cs-137, sulfuric acid, sodium hydroxide, chloride, dissolved solids. water quality: chloride, tritium, Sr-90. storage coefficient, transmissivity, porosity, dispersivity, sorption distribution coefficient.

Robertson, J.B., 1977. Numerical Modeling of Subsurface Radioactive Solute Transport from Waste-Seepage Ponds at the Idaho National Engineering Laboratory; U.S. Geological Survey, IDO-22057, 67 pages.

Abstract or Summary:

A three-segment numerical model was developed to simulate the percolation of low-level radioactive effluent through interlayered basalts and unconsolidated sediments and an extensive zone of perched water. The model included the effects of convection, hydrodynamic dispersion, radioactive decay, and adsorption. The first segment uses an analytical solution to simulate transport from the ponds to the 25-m thick perched water lens, assuming steady vertical flow through a 15-m long saturated homogeneous column. The second segment simulates two-dimensional horizontal transport in the perched water body using finite-difference methods, assuming complete vertical mixing with vertical leakage from the bottom. The third segment of the model simulates vertical solute transport from the perched water body toward the aquifer by assuming unsaturated, but steady, water flow in a series of contiguous, nonhomogeneous independent vertical columns.

Data:

generalized stratigraphy, porosity, hydraulic conductivity. liquid waste: volume, gross radioactivity, source, Ce-144, Co-60, Cr-51, Cs-137, tritium, Sr-90, Pu-239, Am-241, sulfuric acid, sodium hydroxide, sodium chloride. water quality: chloride, tritium, Sr-90, Co-60. perched water: altitude, areal extent

Robertson, J.B., R. Schoen and J.T. Barraclough, 1974. The Influence of Liquid Waste Disposal on the Geochemistry of Water at the National Reactor Testing Station, Idaho: 1952-1970; U.S. Geological Survey, IDO-22053, 231 pages.

Abstract or Summary:

This report presents a summarized evaluation of the geology, hydrology, and water geochemistry of the NRTS and the associated influences of subsurface liquid waste products discharged from the NRTS facilities. The progressive buildup, and changes of both radioactive and chemical wastes are analyzed for the period of 1952-1970. Of principal concern is the fate of wastes discharged from the NRTS in the Snake River Plain aquifer. Runoff from the mountain fringes of the plain recharges ground water in the Snake River Plain aquifer. Ground water beneath the NRTS is of exceptionally good quality with low dissolved solids due to the abundant precipitative recharge in surrounding mountains, the high permeability of aquifer and short residence time of most groundwater, the relative inertness of the basaltic matrix, and the mildly alkaline composition of the recharge to the aquifer. Irrigation recharge water can be readily distinguished from ordinary ground water by its higher content of dissolved solids, higher nitrate, and warmer temperature. Since 1952, the NRTS facilities have discharged 1.6×10^{10} gallons of liquid waste containing 7×10^4 curies of radioactivity and about 1×10^8 pounds of chemicals to the subsurface. The discharge has been disposed of through wells and seepage ponds. The principal waste products include tritiated water, Sr-90, Cs-137, Co-60, sodium chloride, chromates, and heat. Wastes at the NRTS have been distributed in the Snake River Plain aquifer and overlying bodies of perched ground water according to hydrologic and geochemical controls. Expansion of the plume of waste products in the aquifer from the ICPP disposal well has been traced over the years. Chloride and tritium in this plume are most widely distributed, detectable over about 15 square miles of the aquifer. Migration of cationic waste products, especially Sr-90 and Cs-137, has been greatly retarded by sorption. Radioactive decay is a significant influence on the spreading and dilution of wastes as they move down gradient in the aquifer. Materials and heat balances calculated for the ICPP wastes indicate that the interpretive subsurface distributions are valid and that the wastes generally remain in the upper 250 feet of the aquifer. Waste plumes from TRA and NRF are poorly defined because of insufficient observation wells.

Data:

well hydrograph, Big Lost River hydrograph, infiltration rate, recharge, generalized stratigraphy, distribution coefficient, transmissivity, velocity, water quality: temperature, color, pH, specific conductance, total dissolved solids, calcium, magnesium, sodium, potassium, bicarbonate, carbonate, sulfate, chloride, nitrate, fluoride, silica, iron, hardness, heat, perched water: ICPP, TRA, NRF, areal extent, altitude, tritium, Sr-90, Cs-137, Co-60, chloride, specific conductance, well hydrograph, liquid waste: radioactivity, volume, tritium, Sr-90, Cs-137, Co-60, Sr-89, Zr-95, Nb-95, Rh-106, Ru-106, I-131, Ce-144.

Rood, A.S., 1992. GW SCREEN: A Semi-Analytical Model for Assessment of the Ground Water Pathway From Surface or Varied Contamination: Theory and Users Manual; EG&G Idaho, Inc., EGG-GEO-10158, 82 pages.

Abstract or Summary:

GW Screen was developed for assessment of the ground water pathway for leaching of radioactive and nonradioactive substances from surface or buried sources. The code was designed for implementation in the track 1 and track 2 assessments of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites identified as low probability hazard at the Idaho National Engineering Laboratory. The code uses a mass conservation approach to model three processes: (1) contaminant release from source volume, (2) contaminant transport in the unsaturated zone, and (3) contaminant transport in the saturated zone. The source model considers adsorptive properties and solubility of the contaminant. Transport in the unsaturated zone is described by a plug-flow model. Transport in the saturated zone is calculated with a semianalytical solution to the advective dispersion equation for transient mass flux input. One of the limitations of this code is that it does not deal with radioactive progeny. Radioactive progeny were ignored because very few of the sites identified for assessment contained radionuclides with long decay chains that would have significantly ingrowth of decay progeny. GW Screen has shown comparable results when compared against other codes using similar algorithms and has also been shown to provide bounding estimates of ground water concentrations when compared to results from complex numerical codes. This code was designed for assessment and screening of the ground water pathway when field data are limited. It was not intended to be a predictive tool. Few data are presented. There are some computer generated curves of concentration; however, there is a curve presented and saturated conductivity values based on laboratory measurements on vesicular basalt specimens which differ from other measured values by four orders of magnitude. The values presented in this report were characterized in detail by Bishop 1991, McElroy 1990, and Van Genuchten fitting parameters were given by Bacca 1992.

Data:

Hydraulic conductivity for basalt and interbed sediments.

Rope, S.K., W.J. Arthur, T.H. Craig and E.H. Craig, 1988. Nutrient and Trace Elements in Soil and Desert Vegetation of Southern Idaho; U.S. Department of Energy, Idaho Falls, 23 pages.

Abstract or Summary:

Concentrations of 30 elements were measured in strong acid extracts of soil, sagebrush, (*Artemisia tridentata* SSP), leaves and perennial grass from the Idaho National Engineering Laboratory (INEL) and two reference sites in southern Idaho. A bicarbonate-chelating extract of soil was used to estimate plant-available concentrations. The results provide baseline data prior to start up of a coal-fired steam-generator facility on the INEL and other developments in the region. In addition, existing impact from effluents from 30 years of a nuclear fuel reprocessing facility on the INEL was evaluated. Based on the spacial distribution of element concentrations, as well as comparison with reference sites, we conclude that concentrations of zinc, and perhaps nickel, cadmium and vanadium are currently elevated around the fuel reprocessing facility. The spacial distribution of these elements is similar to that of Cs-137 which is emitted by the facility. Sagebrush and soil would be more responsive than perennial grass for long-term monitoring of element concentrations in this semi-arid environment.

Data:

Surficial soil, pH, organic matter, cation exchange capacity, texture, ground concentrations and specific chemicals, Al, Fe, Mg, Ca, K, P, Mn, Ti, F, Na, Ba, Zn, Sr, V, Ni, Cu, Cr, Pb, B, As, Cd, Be, Se, Hg, Tl, F, Hg. Various vegetation, such as grass and sagebrush were also analyzed for the same parameters.

Schmalz, B.L., 1968. Liquid Waste at the National Reactor Testing Station, Idaho; U.S. Atomic Energy Commission, Idaho Operations Office, IDO-12066, 24 pages.

Abstract or Summary:

Briefly describes the systems which dispose liquid waste to the lithosphere. It is organized on the basis of three categories (sanitary sewage, radioactive and industrial wastes) and summarizes the volumes and contaminants involved.

Data:

plans of sanitary sewage disposal facilities at NRTS locations and characteristics, flow, design capacity. liquid waste: volume, source, gross radioactivity for 1961 to 1967, hexavalent chromium, sulfuric acid, sodium hydroxide, sodium chloride, polyphosphate, silicic acid, phosphate, sulphur trioxide, morpholine, ammonia, hydrozene, calcium, magnesium, sodium, potassium, zinc, chloride, sulfate, nitrate, silica.

Schmalz, B.L., 1972. Radionuclide Distribution in Soil Mantle of the Lithosphere as a Consequence of Waste Disposal at the National Reactor Testing Station; U.S. Atomic Energy Commission, IDO-10049, 80 pages.

Abstract or Summary:

This report is a study of the distribution of radionuclides in the soil resulting from disposal of liquid and solid waste at the NRTS. The situation involving liquid waste is appraised by: (a) mathematical models using parameters determined in the laboratory; (b) physical models using soil samples and simulated waste solution; and (c) sampling of soil and water where waste is being discharged. In the case of Sr-90, the data obtained indicate that the sorption capacity of the alluvial deposits between the disposal pond bottoms and the basalt bedrock has been reached. The data for cesium (Cs) were erratic but the most pessimistic interpretation indicates that the capacity of the alluvium has not been reached. The amount of Co-60 estimated to be in the alluvium is greater than that reported to have been discharged. Co-60 retention in the soil is attributed to reactions other than ion exchange. A theoretical appraisal of the migration of radionuclides at the burial ground (RWMC) indicates that the potential hazard is small under well-drained circumstances. Leaching of waste and the migration of some fission products as well as plutonium isotopes and daughter products is shown to have occurred to a very limited extent. This is inferred to have resulted from inundation of waste as a result of floods caused by snowmelt runoff. The concentrations and distances migrated are small and are not interpreted as a cause for concern in regard to effects on the regional aquifer system. A hypothetical evaluation is included of the environmental problems remaining after active operation of a disposal site has been discontinued. It is concluded that disposal sites can be used for other purposes with certain restrictions.

Data:

distribution coefficient, grain size distribution, leaching column study, liquid waste: volume, radioactivity, source, Sr-90, Cs-137, Co-60, Ce-141, Ce-144, tritium, gross radioactivity, sodium, potassium, calcium, magnesium, lithium, ammonia, sulfate, nitrate, phosphate, chloride, fluoride, bicarbonate, carbonate, pH, surficial sediment: specific radioactivity, radioactivity profile, gross alpha radioactivity, gross gamma radioactivity, Cs-137, Sr-90, Co-60, Ce-144, pond sediment: specific radioactivity, total radioactivity, radioactivity profile, Cs-137, Sr-90, Co-60, Ce-144, water quality: radioactivity, distribution, Cs-137, Sr-90, Co-60, Ce-144, solid waste: volume, source, radioactivity, U-238, U-235, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Am-241, gross alpha radioactivity 1969 RWMC flood water, perched water: radioactivity, alpha, beta, gamma, buried waste soil: radioactivity, U-234, U-235, U-238, Pu-239, Am-241.

Schmalz, B.L. and W.L. Polzer, 1968. Tritiated Water Distribution in Unsaturated Soil; U.S. Atomic Energy Commission, Idaho Operations Office, in Soil Science Volume 108, Number 1, 5 pages.

Abstract or Summary:

The leaching of radioactive waste in contact with soil prompted this investigation in which the tritium in unsaturated soil was measured to study the movement of water. It has been recognized that the movement of tritium is influenced by reactions with soil constituents resulting in slight deficiencies as a perfect tracer. It compares well with other tracers, however. In this investigation, advantage was taken of the presence of tritium in rainfall to develop an approximation of the amount retained in the soil and its distribution under in situ conditions. Soil samples were obtained from three proximal locations at the NRTS in southeastern Idaho. The tritium concentrations were determined in the water extracted from these samples with the objective of testing the applicability of existing theory to explain the observation.

Data:

Surficial soil, texture, porosity, moisture content, precipitation, surficial sediments, tritium

Shuter, E. and G.E. Brandvold, 1952. Water Levels in Wells in Bingham, Bonneville, Butte, and Jefferson Counties, Idaho; U.S. Geological Survey, IDO-22017-USGS, 99 pages.

Abstract or Summary:

This report contains ground surface and water level elevation or depth to water table data for wells in the named counties for 1949-1951. No analysis of data is presented.

Data:

well: use, depth, location. regional water table. well hydrograph

Sisson, J.B. and G.C. Ellis, 1990. Summary Report of Results of the Vapor Vacuum Extraction Test at the RWMC; EG&G Idaho, Inc., EGG-WM-9301, 39 pages.

Abstract or Summary:

A test-scale vapor vacuum extraction system was operated for four months at the RWMC. The extraction system removed more than 65 million cubic feet of soil gas containing 429 kg of carbon tetrachloride and 164 kg of trichloroethylene. Hydraulic properties of the basalts were estimated and input into a numerical transport model. The model simulations indicated that a rubble zone at 190 ft dominated the soil gas flow pattern. Refined calibration of transport models will allow enhancement of the production system design to increase operational efficiency and effectiveness.

Data:

soil gas extraction rate profile, vacuum versus flow rate, borehole pressure, hydraulic conductivity, carbon tetrachloride: concentration profile, concentration versus time, concentration versus depth

Stewart, J.W., 1950. Results of Pumping Test on STR production Well 1, Atomic Energy Commission Reactor-Testing Station, Idaho; U.S. Geological Survey, IDO-22008, 6 pages.

Abstract or Summary:

Results are presented of a aquifer test at a production well at the Submarine Testing Reactor Plant (STR) in 1950.

Data:

discharge-drawdown, borehole: flow, location, hydraulic conductivity, transmissivity, well: use, depth, location.

Stewart, J.W., 1950. Results of Pumping Test number 2 on MTR (Materials Testing Reactor) Production Well AC1, Arco Reactor-Testing Station, Idaho; U.S. Geological Survey, IDO-22007, 9 pages.

Abstract or Summary:

Results are presented of a pumping test on a production well in 1950. Drawdown at an adjacent well is also presented.

Data:

discharge-drawdown, borehole: flow, location, hydraulic conductivity, transmissivity, well: use, depth, location.

Stewart, J.W., 1951. Results of Tests on Wells at Sites 3 and 7, NRTS, Idaho; U.S. Geological Survey, IDO-22011-USGS, 28 pages.

Abstract or Summary:

This memorandum summarizes and reviews the results of artificial recharge, discharge-drawdown, and pumping tests by the USGS at sites 7 (ICPP) and 3 (Submarine Thermal Reactor, STR) on the NRTS. The tests were used to obtain information about the water-bearing properties of the aquifers, build-up of the water level in intake wells, the local effect of this build-up on the water table, the lateral extent of the cones of elevation and depression, and the minimum desirable spacing of production and waste disposal wells.

Data:

discharge-drawdown, transmissivity, storativity, driller's log, recharge curves.

Tkackyk, J.W., K.C. Wright, P.D. Ritter, R.N. Wilhelmsen, W.M. Helleson, 1989. Annual Report-1988 Environmental Monitoring for EG&G Idaho Facilities at the Idaho National Engineering Laboratory; EG&G Idaho, Inc., EGG-2564, 108 pages.

Abstract or Summary:

This report describes the 1988 environmental monitoring activities at EG&G operated facilities at INEL. Additional monitoring activities are also discussed, including preliminary radiological characterization of other facilities, drinking water monitoring, nonradiological liquid effluent monitoring, subsurface investigation, and data management. The primary purposes of monitoring are to evaluate environmental conditions and to provide information, in compliance with applicable regulations and interpreted as necessary, for insuring protection of personnel, the public and the environment.

Data:

air quality: gross beta radioactivity, Sb-125, Am-241, Pu-239, Pu-240, Sr-90, Pu-238. surface water quality: Cs-137, Co-60. water quality: tritium, specific conductance, chloride, sodium, carbon tetrachloride, chloroform, 1,1,1-trichloroethane, trichloroethylene, tetrachloroethylene, dichlorodifluoromethane, toluene, 1,1-dichloroethane, 1,1-dichloroethylene. surface soil: Cs-137, Pu-238, Pu-239, Pu-240, Am-241, Sr-90.

Tkackyk, J.W., K.C. Wright and R.N. Wilhelmsen, 1990. Annual Report-1989 Environmental Monitoring for EG&G Idaho Facilities at the Idaho National Engineering Laboratory; EG&G Idaho, Inc., EGG-2612, 87 pages.

Abstract or Summary:

This report describes the 1989 environmental monitoring activities at EG&G operated facilities at INEL. Additional monitoring activities are also discussed, including drinking water monitoring, nonradiological liquid effluent monitoring, as well as data management. The primary purposes of monitoring are to evaluate environmental conditions and to provide information, in compliance with applicable regulations and interpreted as necessary, for insuring protection of personnel, the public and the environment.

Data:

air quality: gross beta radioactivity, small mammals: Sr-90, Pu-238, Pu-239, Pu-240, U-234, U-235, U-238, Am-241, surface water quality: Cs-137, water quality: tritium, specific conductance, chloride, sodium, carbon tetrachloride, chloroform, 1,1,1-trichloroethane, trichloroethylene, tetrachloroethylene, dichlorodifluoromethane, toluene, 1,1-dichloroethane, 1,1-dichloroethylene.

U.S. Department of Energy, 1991. INEL Site Environmental Surveillance Data for the First Quarter, 1991; U.S. Department of Energy, 39 pages.

Abstract or Summary:

This report summarizes data from analyses of samples collected at INEL Site locations during the first quarter of calendar year 1991. Data were obtained from analyses of air and from analyses of well and surface water samples.

Data:

monitoring program description, regional water table, perched water altitude, air quality: gross alpha radioactivity, gross beta radioactivity, Be-7, Ce-141, Cd-144, Co-60, Cs-134, Cs-137, Mn-54, Ru-103, Ru-106, Sb-125, Zr-95, Sr-90, Pu-238, Pu-239, Pu-240, Am-241, tritium, nitrogen dioxide, sulfur dioxide, water quality: gross alpha radioactivity, gross beta radioactivity, tritium, Sr-90, specific conductance, total chromium, gamma spectrometric analysis, carbon tetrachloride.

U.S. Department of Energy, 1991. INEL Site Environmental Surveillance Data for the Fourth Quarter, 1990; U.S. Department of Energy, 50 pages.

Abstract or Summary:

This report summarizes data from analyses of samples collected at INEL Site locations during the fourth quarter of calendar year 1990. Data were obtained from analyses of air and from analyses of well and surface water samples, and from direct radiation measurements.

Data:

monitoring program description, regional water table, perched water altitude, ionizing radiation exposure, air quality: gross alpha radioactivity, gross beta radioactivity, Be-7, Ce-141, Cd-144, Co-60, Cs-134, Cs-137, Mn-54, Ru-103, Ru-106, Sb-125, Zr-95, Sr-90, Pu-238, Pu-239, Pu-240, Am-241, Kr-85, tritium, nitrogen dioxide, sulfur dioxide, total suspended particulates, water quality: gross alpha radioactivity, gross beta radioactivity, tritium, Sr-90, specific conductance, total chromium, gamma spectrometric analysis, carbon tetrachloride.

Van Deusen, L. and B. Trout, 1990. Phase I Remedial Investigation/Feasibility Study Work Plan and Addendums for the Warm Waste Pond Operable Unit at the Test Reactor Area of the Idaho National Engineering Laboratory (Volume I); EG&G Idaho, Inc., EGG-WM-8814.1, 129 pages.

Abstract or Summary:

The Idaho National Engineering Laboratory (INEL) was listed on the National Priorities List of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in November 1989. One of the reasons for this listing was the release of contaminants, primarily chromium and radionuclides, were released to the environment at the TRA Warm Waste Pond and the TRA Disposal Well. Other contaminants may also have been released at these facilities. In response to the listing, the Department of Energy (DOE), the Environmental Protection Agency (EPA), and State of Idaho are implementing appropriate responses for the release sites under provisions of CERCLA. At the TRA release site, this response has been initiated by implementing immediate responses and by preparing a Remedial Investigation/Feasibility Study (RI/FS) Work Plan and Addendums. The purpose of the RI/FS for the TRA Warm Waste Pond Operable Unit is to determine the remedial action. In connection with the study, this work plan will include site background, initial evaluation, data quality objectives, RI/FS tasks, costs, and schedule. The site background includes meteorology and air quality monitoring, regional and local geology, hydrogeology, vegetation and wildlife, waste descriptions and existing characterization data.

Data:

air quality, precipitation, lithology, geologic cross sections, regional water table, specific conductance, lithologic logs, geophysical logs, wind: direction, speed, rose, discharge: Big Lost River, water quality: turbidity, total dissolved solids, nitrate, ortho phosphate, hardness, calcium, sulphate, fluoride, specific conductivity, alkalinity, iron, manganese, sodium, potassium, chloride, total suspended solids, geology: regional, basalts: flow group, thickness, sedimentary interbed: thickness, borehole: locations, porosity, transmissivity, grain size distribution, storage coefficient, aquifer thickness, contaminant plumes, perched water: altitude, vegetation, small animals, big game, liquid waste: volume, radioactivity, extent, distribution, Ag-110, Ar-41, Am-241, Ba-140, Cd-115, Ce-141, Ce-144, Cm-244, Co-58, Co-60, Cr-51, Cs-134, Cs-137, Fe-59, tritium, Hf-181, I-129, I-131, I-132, I-133, I-135, La-140, Lu-177, Mn-54, Mn-56, Mo-99, Na-24, Nb-95, Nb-97, Nd-147, Np-239, Pu-238, Pu-239, Re-188, Rh-106, Ru-103, Ru-106, Sb-122, Sb-124, Sc-46, Sr-89, Sr-90, Sr-91, Sr-92, Ta-182, Tb-160, Tc-99M, Te-132, Te-129, W-187, Xe-133, Xe-135, Y-90, Y-91m, Y-92, Y-93, Y-97, Zn-65, Zr-95, Zr-97, source, concentration, sediment: acetone, acrylonitrile, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, di-n-octylphthalate, pentachlorophenol, arsenic, beryllium, cadmium, chromium, cyanide, lead, mercury, silver, sulfide, TOC, zinc, Am-241, U-232, U-234, U-238, Pu-238, Pu-239, Cm-244, Cr-51, Co-60, Cs-134, Cs-137, Sr-90.

Van Haaften, D.H., K.N. Koslow, and C.J. Naretto, 1984. Hydrologic Analysis of a Mackay Dam Failure During a Probable Maximum Flood on Big Lost River, Idaho; EG&G Idaho, Inc., Thermal and Process Analysis Branch, Earth and Life Sciences Branch, SE-A-84-018, 66 pages.

Abstract or Summary:

This is included as a supplement to Appendix E. This analysis was performed at the proposed New Production Reactor primary site E on the Idaho National Engineering Laboratory site. The analysis determined the flood conditions resulting from an assumed inflow to Mackay Reservoir equal to the probable maximum flood for the watershed and the consequent failure of Mackay Dam. The failure mode was assumed to be over topping and subsequent breaching of the earthen structure. The National Weather Service computer code DAMBRK, a flood prediction model was employed to calculate the flood water elevations, flow rates, velocities and flood wave arrival times along the Big Lost River from the dam to the Big Lost River sinks on the INEL where the river terminates. Flood predictions were determined for a range of overtopping depths, dam failure times, reach widths and lateral flow loss conditions. Results indicate that extensive flooding with very low depths would occur on the INEL under the worst case conditions. The proposed NPR site is not subject to flooding because the site is approximately 57 feet above the peak flood stage calculated.

Data:

There are no actual field data in this report.

Walton, J.C., A.S. Rood, R.G. Baca, M.D. Otis, 1988. Model for Estimation of Chlorinated Solvent Release from Waste Disposal Sites; EG&G Idaho, Inc, in Journal of Hazardous Materials, Vol 21, pages 15-34, EGG-J-88055, 19 pages.

Abstract or Summary:

A mathematical model was developed to estimate the release and transport of chlorinated solvents from hazardous waste sites located in the vadose zone. The model formulation accounts for container degradation, interphase mass transfer, waste decomposition, soil temperature effects on physical and chemical properties of the waste, and mass transport through geologic media. Aqueous, nonaqueous, and vapor transport were considered. Calculations indicate the dominant transport mechanism is vapor diffusion to the surface and vadose zone. Model predictions also indicate an annual cycle of release caused by changes in soil temperature. The model was applied to an existing waste facility containing five chlorinated solvents. Reasonable agreement was found between model calculations and field data.

Data:

sediments: carbon tetrachloride, machine oil, tetrachloroethylene, chloroform, 1,1,1-trichloroethane.

**Westinghouse Idaho Nuclear Co, 1991. CPP-55/06 Sampling and Analysis Data Package;
Westinghouse Idaho Nuclear Co. and Golder and Assoc.**

Abstract or Summary:

This is a collection of soil and water sample data from the area around the Chemical Processing Plant, as well as a record of a presentation and a letter to the Idaho Department of Health and Welfare.

Data:

perched water: altitude, thickness, specific radionuclide, total Sr, gamma scan, Sr-90, H-3, I-129, K-40, Cs-137, Ti-208, Pb-212, Pb-214, Si-214, tritium, Ra-226, Bi-212, Bi-214, Y-90, silver, gold, barium, beryllium, calcium, cadmium, copper, iron, potassium, magnesium, manganese, sodium, lead, antimony, tin, zinc, methylene chloride, organics, hydrocarbons. surficial sediment: altitude, thickness, specific chemical, aluminum, antimony, arsenic, barium, cadmium, chromium, iron, lead, mercury, nickel, selenium, silver, sodium, sulfide, potassium, beryllium, calcium, cobalt, copper, cyanide, thallium, tin, vanadium, zinc, specific radionuclide, Sr-90, K-40, Am-241, Pu-238, Np, Sb-125, Co-60, Co-58, I-129, Ce-144, Ru-103, Ru-106, Cs-134, Cs-137, K-40, U-238, U-235, U-234. sedimentary interbed: altitude, thickness, specific chemical, aluminum, antimony, arsenic, barium, cadmium, chromium, iron, lead, mercury, nickel, selenium, silver, sodium, sulfide, potassium, beryllium, calcium, cobalt, copper, cyanide, thallium, tin, vanadium, zinc, specific radionuclide, Sr-90, K-40, Am-241, Pu-238, Np, Sb-125, Co-60, Co-58, I-129, Ce-144, Ru-103, Ru-106, Cs-134, Cs-137, K-40, U-238, U-235, U-234. basalt: altitude, thickness, specific chemical, aluminum, antimony, arsenic, barium, cadmium, chromium, iron, lead, mercury, nickel, selenium, silver, sodium, sulfide, potassium, beryllium, calcium, cobalt, copper, cyanide, thallium, tin, vanadium, zinc, specific radionuclide, Sr-90, K-40, Am-241, Pu-238, Np, Sb-125, Co-60, Co-58, I-129, Ce-144, Ru-103, Ru-106, Cs-134, Cs-137, K-40, U-238, U-235, U-234. borehole: log. water quality: chloride, nitrate, tritium, Sr-90, dioxins, furans, herbicides, metals, pesticides, PCB, volatile organics, specific conductance, pH, temperature, turbidity.

Wood, T.R., 1990. Impact of Surface Water Recharge on the Design of a Ground Water Monitoring System for the RWMC Idaho National Engineering Laboratory; in Proceedings of the 1990 Annual Symposium on Engineering Geology and Geotechnical Engineering, Idaho State University; EG&G Idaho, Inc., 17 pages.

Abstract or Summary:

Recent hydrogeologic studies have been initiated to characterize the hydrogeologic conditions at the RWMC at the INEL. Measured water levels and wells penetrating the Snake River Plain aquifer near the RWMC and the corresponding direction of flow show change over time. This change is related to water table mounding caused by recharge from excess water diverted from the Big Lost River for flood protection during high flows. Water levels in most wells near the RWMC rise on the order of 10 feet (3 meters) in response to recharge with water in one well rising over 60 feet (18 meters). Recharge changes the normal south-southwest direction of flow to the east. Design of the proposed ground water monitoring network for the RWMC must account for the variable directions of ground water flow.

Data:

regional water table, well hydrograph, INEL diversion discharge

Wood, T.R., 1991. Impact of Surface Water Recharge on the Design of a Groundwater Monitoring System for the RWMC, INEL; EG&G Idaho, Inc., EGG-M-9016, 17 pages.

Abstract or Summary:

Recent hydrogeologic studies have been initiated to characterize the hydrogeologic conditions at the RWMC at the INEL. Measured water levels in wells penetrating the Snake River Plain aquifer near the RWMC and the corresponding direction of flow show change over time. This change is related to water table mounding caused by recharge from excess water diverted from the Big Lost River for flood protection during high flows. Water levels in most wells near the RWMC rise on the order of 10 ft in response to recharge, with water in one well rising over 60 ft. Recharge changes the normal south-southwest direction of flow to the east. Design of the proposed groundwater monitoring network for the RWMC must account for the variable directions of groundwater flow.

Data:

regional water table, well hydrograph, INEL diversion discharge.

Wood, T.R., L.C. Hull, M.H. Doornbos, 1989. Groundwater Monitoring Plan and Interim Status Report for Central Facilities Landfill II; EG&G Idaho, Inc., EGG-ER-8496, 80 pages.

Abstract or Summary:

This document is an interim status report and a Groundwater Monitoring Plan for Central Facilities Area Landfill II (Landfill II) at the Idaho National Engineering Laboratory. This effort is governed by the hazardous waste regulations promulgated under the Resource Conservation and Recovery Act, which require all Land Disposal Units operational after November 1980 to have a groundwater monitoring system to detect possible release of hazardous constituents into the environment. Identification and characterization of the local geology and the upper aquifer is necessary to design a groundwater monitoring program appropriate to the site for post-closure monitoring. This document will provide description of Landfill II, describe the work that has been conducted to date, and describe the work which is planned to characterize the hydrogeology at the site. Selecting a post-closure option for Landfill II requires the implementation of a detection groundwater monitoring system. Post-closure groundwater monitoring detection systems are developed in phases. The phases include Characterization of Site Hydrogeology, Monitoring Well Placement and Design Criteria, Sampling and Analyses Plan, and Evaluation of Monitoring Data. This report constitutes an interim status report of Phase 1, Characterization of Site Hydrogeology. This report includes but is not limited to the physiography, climatology, regional geology, local geology, and the groundwater hydrogeology of Landfill II as well as the area around the site. It also includes the drilling program that has been performed at the landfill and future work which will continue at the site. The program includes shallow and deep drilling program. Future work includes proposed well drilling, a completed monitoring well network and site characterization work.

Data:

borehole: locations. solid waste: volume, source, location. climatology, physiography. geology: regional, local. aquifer: altitude, thickness, transmissivity, storage coefficient. contaminant plumes: sodium, nitrate, specific conductance, chloride. water quality monitoring program: arsenic, barium, chromium, selenium, silver. sediments: volatile organics, semivolatile, PCB, PAH, metals

Wood, W.W. and W.H. Low, 1986. Aqueous Geochemistry and Diagenesis in the Eastern Snake River Plain Aquifer System, Idaho; U.S. Geological Survey, in Geological Society of America Bulletin Volume 97, ISSN 0016-7606, 10 pages.

Abstract or Summary:

Water budget and isotopic analysis of water in the eastern Snake River Plain aquifer system confirm that most if not all of the water is local meteoric in origin. Solute mass balance arguments suggest that 5×10^9 moles of calcite and 2.6×10^9 moles of silica are precipitated annually in the aquifer. Isotopic evaluations of calcite and petrographic observation of silica support the low temperature origin of these deposits. Approximately 2.8×10^9 moles of chloride, 4.5×10^9 moles of sodium, 1.4×10^9 moles of sulphate and 2×10^9 moles of magnesium are removed annually from the aquifer framework by solution. Proposed weathering reactions are shown to be consistent with mass balance, carbon isotopes, observed mineralogy and chemical thermodynamics. Large quantities of sodium, chloride and sulphate are being removed from the system relative to their abundances in the rock.

Sedimentary interbeds which are estimated to compose less than 10% of the aquifer volume may yield as much as 20% of the solutes generated within the aquifer. Weathering rate of the aquifer framework of the eastern Snake River Plain is 14 megagrams per square kilometer per year or less than half the average of the North American continent. This contrasts with the rate for the eastern Snake River Basin of 34 megagrams per square kilometer per year, which is almost identical to the average for the North American continent. Identification and quantification of reactions controlling solute concentrations from ground water in the eastern Snake River Plain aquifer indicate that the aquifer is not an inert bathtub that simply stores and transmits water and solutes but is undergoing active diagenesis and is both a source and a sink for solutes.

Data:

Water quality: ground water, surface water, Ca, Mg, Na, K, HCO_3 , Cl, SO_4 , F, SiO_4 , Fe, basalt solids, pH, temperature, dissolved oxygen, deuterium and O-18.

END

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3/15/94