UNIVERSITY OF PUERTO RICO PUERTO RICO NUCLEAR CENTER BUDGET FY-1978 Project Proposals and Authorizations RESEARCH PROGRAMS The contents of this document are administratively confidential (Revised 6/14/76) ---Page Break--- ---Page Break--- UNIVERSITY OF PUERTO RICO Puerto Rico Nuclear Center RESEARCH PROGRAMS ‘Terrestrial Ecology Program Murine Pollution Studies Health Impact of Hydroelectric Power Reservoirs Environmental Research Park Bikini Epidemiological Models Effects of Fossil Fuel Pollutants on Human Health Marine Research Ship Operations ---Page Break--- ---Page Break--- ---Page Break--- ---Page Break--- Oak Ridge Operations ML 2. 3. 4. 8. ne + Project Term: cont: SCHEDULE 189 Additional Explanation for Operating Costs University of Puerto Rico - Contract No. E-(40-1)-1832 BUDGET FY - 1978 189 No. 21 Rev. 5/14/76 Project Title: Terrestrial Ecology Security Classification or Project: Confidential Budget Activity No.: 2-03-01 Date Prepared: April, 1976 Method of Reporting: Annual Progress Report Working Location: Río Piedras Person in Charge: Dr. Richard G. Clements Years: FY-1976 FY-1977 FY-1978 a. Scientific 5.0 1,003.95 b. Other Direct 85,000 235 Total 85,000 13.90 Operating Costs: a. Direct salaries plus Fringe benefits (from Appendix 4) 137,800 29,900 124,600 b. Overhead Costs 103,300 22,109 75,100 c. Travel 2,000 1,000 4,000 d. Materials and Supplies 12,600 3,305 13,100 e. Other Services (Itemized in Item 19) 19,300 5 22,900. Total 275,000 62,900 250,000 Equipment Obligation: 20,000 = 20,000 FY1978 5.95 12.95 18.90 190,277 106,535 8,000 21,730 27,458 20,000 ---Page Break--- ‘weap wmMsIND f wt x x x | tay an macect| | I 21s tags sarin, | wmowmmorm| x fox | x | xf xf xf xl x dal « (1a 1g wmismeenses| x fx fox | ox | xf xf xt x fal « say 2590 a a awwvnor * anu owv wouvariens eeu Hoy yraeany ---Page Break--- (ses 6606 (5161) °Ps 1-4 ume Atoeg mein ---Page Break--- awnynor Sssupous Houvaszy aw woUvaNand 2 song Ato3 munsuDg ---Page Break--- ---Page Break--- Terrestrial Ecology

Prvicran 289 Mo. 22 13. Reports and Presentations, VY-76 Clements, R., E. Cuevas, C. Cnlén, A. Estrada and J. deasio, 19M. Terrestrial Biology of the HORCO-? Site, Telote, Puerto Rico. UBARC Docket No. 50-376, cap. 2.7, BMRA db, Cuevas Be Changes in Selected Water Quality, by Land Use Patterns in the Espirit Santo Drainage Basin. PRIC-295, 70 pp. Block AM. and 2 elements, 17%. Pre-operational Monitoring for 1080-1 S125, Telote, Puerto Rico. eh! No. 500375, Chap. 6.3, FAVA. ish, 197, Radioloresas ABC’ Docket No. 50-276, Block, Ad 5. o. comments and =. Pan Background Data for Puerto Rico. Ut Chap. 7.5, PRR 2, Block AML, ¥. Santos, Ro. / LiNS. "Thermo Turbine-change Boeinet Riec. PRC-19 a, and M, Banus, in torment. Fuerso 2h, Purpose, Need and Peone ‘The purpose of the Espirit Santo Drainage Racing Program is twofold: (1) to provide baseline ecological data for future environmental assessment studies at the local and regional levels and (2) to determine through a whole-system approach the management alternatives for the wise utilization of energy, water and land resources. ‘The study will describe the interrelationships among climate, vegetation, animals, soils and man and their combined influence upon the hydrologic cycle of the drainage basin both at the local and regional levels. Since it encompasses the origin of the whole planning and decision-making process, both of these require data. At present, little is known about the interworkings of a complete, integrated system such as the drainage basin. While many selected, ecologically oriented studies have been conducted in a tropical environment, few, if any, have provided the data base required for environmental management. In view of rapidly changing socioeconomic conditions and material resources limitations, management urgently requires input data from three systems: (1) the physical (geological-meteorological), (2) biological, and (3) cultural. This integrated study has been designed to provide these data. The scope of the Program will deal with the

lytiroloric cycle as it is affected by the interactions of the physical, biological and cultural systems. It will be complete ---Page Break--- Terrestrial Ecology Program 189 No. 2 ws. 16. Multidisciplinary

and utilize the total approach that has been developed within the Terrestrial Program to conduct integrated studies of the climate, soils, vegetation, animals and man. We will begin first with an intensive study of the forest segment of the drainage basin and then incorporate the agricultural lands and urban areas, and finally the estuarine system. Projects using the drainage basin as a unifying concept have been and are being carried out at other locations such as Brookhaven, Sandford, and Holifield National Laboratories. The development of a complete drainage basin study in Puerco Mio would provide valuable information on tropical systems and complement the investigations at the other locations. Exchange of site visits between personnel of the Walker Branch Study at Oak Ridge and the Terrestrial Ecology Program of F.R.N.C. has been programmed. Where feasible, cooperative research will be developed between both programs. ‘Technical Progress in FY-76 A. Research Activities Relating to other ‘The position papers covering the fields of hydrology, soils, plant ecology, animal ecology, limnology, climatology, chemistry and land use have been completed. The final collating and editing of these papers into the 5 year comprehensive research plan will be completed this fiscal year. Research investigations have begun in each of the above areas and are summarized in the following paragraphs. 1. climatology a. Rain Gauge Network A network of twenty storage rain gauge stations has been installed in the forested region of the upper Espiritu Sante. Since little is known of rainfall throughout this area, the purpose of this network is to provide preliminary data on spatial and temporal distribution of precipitation over the watershed. The data obtained will be used to determine the number and location of recording rain gauges that will be re-

Required to provide input to the hydrology program. These stations will also provide preliminary information on the chemistry of rainfall throughout the area. Currently, these stations are being monitored on a bi-weekly basis.

D. Solar Radiation
The input of solar radiation to the study area is being approached from two directions: (1) direct measurement and (2) theoretical. In the aspect applied against an Eppley Spectral Pyranometer are used to provide estimates of solar input to the area. While these instruments will provide data for the energy, the theoretical approach will adjust for slope and angle conditions. A counter is used by validating the area and providing the relative aspect of the study area throughout the year. Rates will change as they adjust to the energy input throughout the year.

This few wind from any source provides recent assessments to determine the contributions pertaining to the terrestrial system.

1) The Hematite Survey of Rio Henintty
The purpose of this survey is to characterize selected physical and chemical properties of the system and to describe the flora and fauna. The survey has been divided into two parts. The first covers a defined portion of the river system, namely Quebrada Indies, Quebrada Conaiora, Quebrada Gramie, Mo Faptrity Caste and its estuary. The second part will be a combined section. The data obtained will serve for the immediate future.

To support the research effort, the surveys have been completed with the reception of water chemistry.

D. Bioassay of Freshwater Occupied Crustaceans
Eight species belonging to the families Atyidae, Palaemonidae, and several others were observed

and reported in the Rio Sapiente Canto and its tributaries. Very little is known of the biology.

Hpflotccers esmae Hifvons, belomine te an! !y (ophistine Tietts ats istribution ti. freshwmters, 1* ome loon ouseasta that & narine phase! nusessary vor th sa2 and Palaenon- However, prelirinary = That fe may Se possto.e tor she seuers = raullllce to coumlete thelr Life cyele 1: “restamates cicaeiayr are cesigned to test this Uecry, ---Page Break--- ‘Terrestrial Boclogy Procran 189 Mo. a2. ©. ‘The Beology of Neriting reclivate ‘This brackish water neritid snat) has invaded the fresh- waters of Rio Lapiritu Santo, and ite tributaries. A report in 1959 noted that et El Verde, 70% of the enaile vere eltuated in pairs and onc vas attached to the doreo-posterior part of the other. ‘The shell ef the lower snail was eroded or being eaten ‘by the attache? one, No further research or observation har been carried out to elucidate this strange phenomenon. ence, field observations and laboratory experiments to deternine the role this mail plays in the ecology of Rio Espiritu Sento have been initiated. Influence of PiysicalChenfcal Factors on the Distribution veshvater Slrimps in the Espiritu Santo River. ‘This study was designed to study the distribution of shrinpe in the upper Espiritu Santo Kiver and correlate the distribution of ca spectes with various physical-chenical factors. 3. Anime Beolesy a, The Role of Caracolus saraco}) in the Forest Ecosyaten ‘Tie role of this snail in the detritus food chain ie poorly understood. It 1s kmom to have diverse feeding habite Ineludine Mohens, mosses, Amgi, leat Vitter, leaves and fruite, The yurpove’ of thic investigation is to’ study the ecology of this anime! and its role in the dynamics of the forest ecosystem. b. Popul on Dynamics of Caracolue caracolia Currently underway is @ study on the population of Caracolue caracolla at three different locations to etudy the effect of vegetation type and cover on the population levels. This etudy Will ‘omplenent the investization deseribet in A above. L, Plant, Reotozy 4, Succession and Rerrovth following Trradiation in « Tropical,

Forest. This project is compiling the census data of the last ten years on the succession and regrowth of vegetation in the radiated site at Fl Verde. It is one of the few sites in tropical areas where long-term follow-up studies have been carried out. The census data for 1969, 1971, 197 and 1975 have been transferred to data cards. Upon completing the transfer of 1967 and 1968 to data cards, the data will be analyzed to evaluate changes in species diversity, growth, and other associated parameters. The final report should be available by the middle of 1977.

---Page Break---

Terrestrial, 169 We. 25 » Le Sper Sumstettas Sa The research proposal for the project is now in the final stages of preparation. It will tie the classic study description to the base depth in terms of the existing data. The hydrology sites are to provide the existing criteria to assess the measurement of streamflow. The ongoing monitoring could provide valuable data. The study aims to determine the actual quality and extent and may be completed this year. The research activities will encompass the entirety of the University of Puerto Rico.

---Page Break---

Terrestrial Ecology Program 189 No. 21, Elvira Cuevas 'Changes in Water Quality as Influenced by Land Use Patterns, 1.8. Molo, University of Puerto Rico. 16. Chamonts, ERNE cohnry lami. "The Influence of Physical Chemical Factors on the Distribution of Freshwater Shrimps in the Espiritu Santo River. M.8. Blol.y University of Puerto Rico. RG. Clements, PRIC Pedro Ceballero Limiting Factors Affecting the Distribution of Garacolus caracolia in the Espiritu.

Santo Fasin. M.S. Biol., University of Puerto Rico. R.G. Clements, 7c Marfa 1. Lebrén Recovery and Succession of Plants Following Gamma Irradiation of a Propteal 2. MeConatek, Untv. Fain Forest. 9.5. Dissertation, Univ. of North Carolina. R.G. Clements, PREC Construction of the new laboratory facility at Fl Verde is still pending and now scheduled for completion in early FY-1977. AT. Expected results 1977 ‘The Program will continue to develop the major research areas set forth in Item 15. Upon completion of the surveys and preliminary investigations Huitiater in =~ 6, the staff will review the results during FY-1@ and propose definitive research investigations for FY-77 that are consistent with the research goals of the Program. It is anticipated that the permanent climatological stations will be installed in the 1400 acre tract of forest in the upper Sepiritu Center. These stations, through a remote sensing system, will provide daily information on rainfall, temperature, and solar radiation throughout the area. Completion of the vegetational survey and mapping of the forested area of the upper Sepiritu Santo in FY-76, will permit the selection and marking of permanent plots for the determination of plant chemistry, litter production and turnover, phenology, seed production-germination, and survival rates of the important species and the physical and chemical properties of soils associated with such vegetation types. In Limnology, work will be expanded on the population dynamics and feeding habits of the crustaceans. More definitive studies will be undertaken in the estuary. This will include the identification of the species of fish that inhabit this portion of the river, the physical and chemical properties of the water, and sediment analysis. It is necessary to establish the baseline conditions of this segment as early as possible because the middle section of the drainage basin is undergoing rapid changes and subsequent.

Impacts will be reflected in this part of the analysis, veining 4m Pi=77. The shaded soil types present will be identified. Bulk samples will be collected from each of the major heritage and determinations will include cation exchange capacity, percent base saturation, major and minor elements, water holding capacity, moisture retention curves, and bulk density. An analysis of the hydrological studies on the Sabana Santo has depended upon the availability of data. The work on plant samples was released as a PRIC publication. Expected Results in FY=2023: The Program will continue to guidelines set forth in the Preservation Plan and Tics 16. At the end of S-77, we will review internally the macros at the goals set forth in the Research Plan. We will conduct an external review of the Program and it will be modified to meet the needs of HIDA. Shop Charges, Reproduction Charges, Transport and Communication, Equipment Maintenance, Tuition, Computer Annual Leave, Miscellaneous, Fleet Rental Charges, Rental of Equipment, Consultant Fees, Reactor Charges, Total ---Page Break--- Terrestrial Ecology Program 289 Wo. 22 20. Description of Capital Equipment by Fiscal Year Expenditures for FY-19/20 will include the purchase of an environmental chamber for investigations such as growth studies and heat tolerance studies where a controlled environment is required. With the expanded fieldwork in the mountainous areas, a repeater station for our present radio network will be purchased. This will enable field crews to maintain communication with the base station at 11 yards in case of an emergency or accident. Lightweight aluminum crank-up towers are required for the permanent installation of our natural temperature, solar radiation monitoring network in the research areas. Smaller items totaling $4,500 will be purchased to support ongoing research. In FY-2023, we are programming the establishment of a weather station at the El Verde site and will require the acquisition of a solar integration integrator, wind monitoring equipment, and a net radiometer. Increased staff.

and research antivirus revire a programmable calculator, X-Y plotter to replace present calculator which is now outdated. "Miscellaneous items to support field research will total approximately 5,009. ae ---Page Break--- — uate wy eT Te ce ECR Ea SEE Br sae y aemy TE on oer umsiosy Soqoor weyers ---Page Break--- g —— wy eee won, ~ FRY OST : - S400 IG ¥ 199907 IK >

erqwumus204; “O78 HOTS, xo3ou PRE 4° suuametnbs SupZOyTUOH DUT soyRsTOVUL WOFARTOSUT WLS, (e) WH drs fexepsc00H ‘Su93] SRODUETLOOSTA (L) sanog quoumaysur : quongay, uoygeo penn uoraerS ‘zayEadet - x9qimay) TENEUMOTAIAL “" "3388883 wer era Ee worMEG NGKEINDE 40 1800 a aouaay TE vox 6gt ---Page Break--- ---Page Break--- ---Page Break--- ---Page Break--- SCHEDULE 189 Additional Explanation for Operating Costs University of Puerto Rico ~ Contract No. E-(40-1)-1833 BUDGET FY - 1978 Oak Ridge Operations 189 No. 23 Bowe 8/14/76 Project Title: Marine Pollution Studies 2, Security Classification: Unclassified Budget Activity No. + Da P-03-01 Prepared: April 1976 - Method of Reporting: Annual Report. Working Location: Mayagüez, Puerto Rico 7. Person in Charge: Dr. J. G. González 8. Project Term: Continuing Before 9. Man Years: FY=1976 _FY-197Q a. Scientific 1.65 Total 9.ur b. Other Direct a3 sca) 28.00 Total «13-91 3.02 ase? 17.47 10. Operating Costs: a. Direct salaries plus Fringe Benefits (from Appendix A) 151,300 52,200 163,900 227, b. Overhead Costs (56% of a.) 113,500 29,000 91,800 17,200 c. Travel 8,000 7,000 00 8,000 d. Materials and Supplies 13,300 18,100 e. Other Services (itemized in Item 19) 35,200 37,000 __32,500 $310,000 $413,009 Total $325,000 1. Equipment Obligations: $ 26,000 s+ $140,000 § 40,000 ---Page Break--- msi) no sma sn cause) x fox |x | x | ox |g ---Page Break--- “isn, 2.008 sa so. wey na ant wr | tg on se oun samo onven meron oot ---Page Break--- (9060) 8 9 nee sn 0 v 009 x suru a Pens img ty arog Pema ad sme oe al are tts at, ---Page Break--- jaw sea nmin ve won fea mor noe ot ---Page Break--- Marine Pollution Studies 289 Ho. 23 13.

Reporte and Presentations, 76 Viconte, Vance P. Benthte Tavertebmtes of Punta Higuero Power Plant Environmental Studies, PRO-174 Viewte, Vance. Beolo communities of Jebus Yay, FR! Vical Aspects of the Sea Grass Com- 6 Kinaol, J.J., R. Castro and P. Davis, 1975. ta Chalupa Miseton WB Pina Report. PHAC-1°S Kinmel, J.J. A Survey of Fishes from Barrio Islote on the North Coast of Puerto Rico, 11th Meeting of the Association of Island Marine Historians Conference, St. Croix, Vile Kimmel, J.J., 1975. A survey of Fish North Coast of Puerto Kier. WSARC Docket K PRRR from Barrio Tslote on the 50-376, Chap. 2.7 Montgomery, J. 1975. A Linear Regression Model of Dissolved Thonganie whoo at the River, Norfolk, Virginia. Paper presented at A.A.A.S. Conference, Seattle, Washington, DC. Montgomery, J. and F.J. Sartianc, 1975. Ionic, Particulate and Organde Forms of Za and Cx in the Guanafivo River and Coastal Zones. 5th National Symposium on Fish Ecology, Corvallis, Oregon. Montgomery, J., S. Kolchmainer and M. Bemis, 1975. Individual Variation of Trace Metal Content in Fish. Nat. Bur. of Standards - 7th Mat. Res. Symposium, Gaithersburg, MD. Montgomery, J. et al., 1975. Leaching of Heavy Metals from Secondary Treated Sewage Sludge by Sea Water and Possible Pathways in Tropical Marine Ecosystem. International Conference on Heavy Metals in the Environment. Ottawa, Ontario. Nutt, M.E., 1975. Zooplankton Environmental Studies, Pi bodies, 1974, in Tortuguero Bay “181, pp. 19455. Nutt, M.E., 1975. Zooplankton Studies 1975 in PL. Manatí Environmental Studies. PAWC-122, pp. 51-56. Nutt, M.E., 1975. Zooplankton Studies 1975 in Pt. Higuero Environmental Studies. PID-132, pp. 51-56. Nutt, K.E., 1975. Zooplankton Studies 1975 in Islote Environmental Studies, PRIDA190. Itt, HAB., 1975. A Year Zo Boast of Puerte & St. Croix, Val. Study of Zooplankton from the North caper presented at A.TAMLL of Caribbean, bo ---Page Break--- Marine Pollution Studies 389 Wo. 2. Burpeso, Weed and Scope, ‘The purpose of the Program is twofold: (1) to

Investigate and evaluate the effects of stresses on the coastal marine environment associated with the continuing development of the largest energy producing and petrochemical complex in Puerto Rico and (2) to determine the management alternatives for the wise utilization of energy and marine resources. The energy complex lines the shores of the Guayanilla and Tallaboa Bays which are protected by offshore reefs and cayos. The dominant current is from east to west. This current

carries pollutants through Tallaboa Bay into Guayanilla Bay and then out to the sea. Tallaboa Bay is fairly open to the sea, whereas water movement in Guayanilla Bay is restricted by a narrow channel, thus favoring the accumulation of pollutants. The source of pollutants is the energy complex on the eastern side of the bay which includes an oil refinery, a fossil fuel power plant, and downstream petrochemical plants. While many independent studies have been conducted in the area, there is a need for an integrated research approach to investigate and evaluate the effects and fates of pollutants introduced into Guayanilla Bay. An integrated team approach will be used to investigate the interaction of physical, chemical, and biological systems in the Guayanilla-Tallaboa Bay area. The research will identify and characterize the pollutants in the area and attempt to describe their transport within and through the bay ecosystem. The stresses on the biological systems caused by these pollutants will be measured and evaluated. Programmatic research over the next five years will be determined by a comprehensive research plan now being developed. Relationship to Other Projects: Cooperative programs are in effect with the University of Minnesota, Oak Ridge Associated Universities, University of Puerto Rico, Puerto Rico Department of Agriculture, and the Department of Natural Resources. Technical Progress in F-19776 A. Research Activities: The program is preparing a comprehensive plan to order the research investigations in the Guayanilla Bay area.

for the next five years. Seven research areas have been identified and position papers are being prepared for each area. These areas are: Chemical Oceanography, Physical Oceanography, Geological Oceanography, Mangrove Ecology, Fish, Plankton, and Benthic Biology. ---Page Break--- Marine Pollution Studies 389 Title, 23 ‘The purpose of the papers is each of the areas as it relates to summarize what is known in the study area. Based upon this, needed research investigations will be identified and assigned priorities within the integrated plan. Presently the papers are being reviewed internally by the staff and when completed will be sent out for outside review. It is anticipated that this document will be ready by the beginning of FL-1977. A reduction of three in the scientific staff has forced the reorganization of work that was scheduled for this year. Work has continued this year on: Trace metal pollutants in sea water and sediments; The effect of thermal plume and energy-related heavy metals on the mangroves, turtle grass beds and their associated organisms; and field experiments on the effects of elevated temperatures, energy-related pollutants and physical oceanography of Guayanilla Bay and adjacent nearshore areas. The research activities and progress in each area is described in the following paragraphs. A. Physical Oceanography The role of the physical oceanography program this year has been to provide supplemental background data in support of research by other investigators. Three cruises were made covering the Guayas River, Tallaboa Bay and surrounding marine coastal areas. Twenty stations were monitored and measurements were taken on temperature, salinity, depth, dissolved oxygen, and phosphate and nitrate concentrations. B. Mangrove Ecology A lagoon in Guayanilla Bay receives the thermal discharge from the energy complex located on the eastern shore. Appropriately one-half of the shoreline of this lagoon supports a mangrove community of the fringing type. On the land side of the mangrove there are...

Sources of man-made ponds which receive waste discharges from the energy complex. Smoke from flare stacks and waste chemical burners waft over the mangrove. Two studies this year have dealt with thermal stresses and trace metal uptake. These are L, Seedling Survival and Growth. The objectives of this study are to determine if the growth and survival of seedlings from stressed areas are comparable to seedlings from non-stressed areas when grown in the thermal lagoon area. During the summer when marine temperatures of 37-40°C are found in the lagoon, none of the seedlings root, grow, and survive as they do in non-stressed areas. When seedlings from the

stressed areas are grown in the normal seawater, survival and growth were found to be inferior to that of seedlings from non-stressed areas. When small trees grow from seeds of non-stressed areas, were ---Page Break--- Marine Pollution Studies 89 No. 13 transplanted in the thermal lagoon, no individuals survived after two weeks with temperature varying between 28-30°C. When this experiment was repeated during the winter months with water temperatures at 33-35°C, growth and survival of seedlings was comparable to the control areas. These studies will be repeated under controlled conditions in the Aquarium.

2. Rare Metal Uptake by Mangrove Seedlings. The purpose of the study is to determine the uptake of Hg, tin, Zn, Cd, Pb, and Cr by young trees from polluted sediments. The study will determine where in the plants concentration occurs. Seedlings were grown in tanks enriched with sewage sludge and levels were compared to seedlings growing at different locations with various burdens of the trace metals. Preliminary data indicate levels of Cu, Zn, and Pb in the plants are related to the location and possibly pollution level. This study will be completed in early FY-1977.

Effect of Stress on Productivity of Mangroves. This is a new project to be initiated in FY-1976 with a duration of two years. It is designed to assess the effects of thermal stress on productivity. It will

involve both field lid Laboratory determinations of primary productivity and respiration of plants at various temperatures. Productivity and respiration of trees from stressed and non-stressed areas will be compared. Effect of Stress on Mangrove Detritus Production and quality. This new project will begin in late FY-1976 with an innovation of approximately two years. Its objectives will be to determine the effects of thermal and chronic stress on the rate of detritus production and its nutritional content. Litter bags will be used to evaluate the rate of detritus formation, items of grazing, population of grazers, and the material will be analyzed to determine the changes in nutrient content and the accumulation of trace metals. Reconnaissance cruises of the Guayanilla-Tataboa area were conducted in order to establish current levels and variability of various environmentally important chemical constituents in the area of water and sediments. A total of 22 stations were established and sampled. Water samples were collected at several depths and grab samples of the surface sediments were also obtained at all stations. In situ determination of temperature, salinity, dissolved oxygen, and visibility were performed during monitoring of the sampling stations. ---Page Break--- Marine Pollution Studies 189 Ho, 13, trace heavy metal analyses were performed for Cu, Zn, Ca, Cr, Mn, Ni, and Pb on water and sediment samples. The distribution of these elements with depth at the various stations has been evaluated with regard to the various physicochemical forms that govern the aqueous marine environment. The analytical techniques used included Anodic Stripping Voltammetry, the Heated Graphite Atomizer Flawless technique, and other flame Atomic Absorption Spectroscopy techniques. Comparison of results by the various techniques is being used to evaluate precision and accuracy of the data. (In addition, water samples have been analyzed for TDP, phosphate, and nitrate to determine the distribution of these parameters with depth at the various stations.

Surface sediment samples were partitioned along a range of size fractions by using sieving techniques. Total trace heavy metal determinations upon strong acid digestion were performed to determine total actual distribution as a function of particle size in the surface sediment. These size fractions were further characterized for the readily available content of these metals as defined by leaching with a reducing dilute acid solution. Flame atomic absorption spectroscopy was used in the determinations. Data reduction and analysis: 1. A Survey of the Fish of the Guayanilla Bay Beginning in July 1975, a survey was initiated to collect and identify the fish community in the

Guayanilla-Talabes, Say areas, in addition to the identification, measurements were taken including density, species, sex, spawning condition, and food habits. Data were also taken on temperature, salinity, habitat, and spatial and temporal distribution. The data will be subjected to correlation analysis to determine the interrelationship between the measured variables and the pollution and/or stress levels found. Plankton Biology The biomass, abundance, and species composition of zooplankton in Guayanilla Bay have been monitored monthly since September 1975. Results from this survey show the copepod Acartia tonsa to be clearly the most important zooplankton form in the shallow areas of the bay. Field and laboratory research has therefore been initiated to investigate the effects of thermal stress on this organism. Vital staining techniques were used to estimate the percentage of copepods in the chronically polluted areas of the bay. Survival, respiration, and excretion experiments are being carried out in the laboratory to evaluate the effects of elevated temperature on the copepod. This work will be completed during PY-104. 00 ---Page Break--- Marine Pollution Studies 189 No. 1 Marine Geology Sediment samples have been taken from Talaboca and Guayanilla Bays in order to study the living and dead foraminifera, one of the

Parvoses of the study of the foraminifera is to use them as environmental indicators. The number of foraminifera, the species and the species diversity is being determined for this purpose. Monitoring is also being used. The results in Tallaboa Bay indicate that dwarf populations of Ammonia beccarii have developed and it consists of a unique feature in the waters surrounding Puerto Rico. Some representative foraminifera of other species are so deformed that they cannot be identified. Populations of other foraminifera appear to be normal. Living specimens of Ammonia beccarii have been collected and bred in the laboratory. The test morphology of these foraminifera is strongly affected by environmental conditions. Different forms of this species occur around Puerto Rico in areas subjected to different pollutants. The laboratory specimens will be submitted to different pollutants to determine their effect on the test morphology.

New projects have been started this year to study the ecology of seagrass beds and mangrove root communities. These communities are the most common, most productive, and most important ecosystems in tropical near-shore environments. The studies are designed to determine the effects of energy-related industrial activities on the environment where these communities are found. Those studies will determine the species composition, species diversity, biomass, zonation, pigment composition, and phenotypic variations in each community.

Only those projects that have a direct relationship to the new research plan now under development will be continued. The meter research plan, which will order the integrated research effort over the next five years, should be ready for review by SHR in early 1977. Some modification of this plan may be forthcoming with the appointment of a new Director of the Program. Primary emphasis will be given to the collection of physical, chemical, and biological data on the Guayanilla Bay area. Analysis and interpretation of

physical oceanographic data 1p scheduled to devin Sn Jamary, 1978 with the appointment of a Physical Oceans researcher. It is now anticipated that the seawater aquarium will be fully operational by early FY-1977. ---Page Break--- Marine Pollution Studies 189 to. 13, 16. Expected Results in FY-1978 The Program will be strengthened this year by the addition of three state positions; one Scientist and two Research Associates. Work will be continued in Guayentla along lines outlined in the Master Research Plan. Under the guidance of internal and external reviews, the Program will be modified as necessary to meet the Objectives of ERDA. 1). Description and Explanation of Other Services. Page Program RT age Power 10,500 7,600 13,000 23,000 Vertices

3,500 5m 5,000 000 Equip. Maintenance 21,500 90 too 3500, Stop Charges 1,600 - - - Direct Charges 50 = . : Reproduction charges 2,000 2,500 2,000, Counter 1000500 2000 2000. Consultant Fees Boy - - : Miscellaneous 6522 500-2400) 2,000, Transg. & Com, 1,500 00-2500 21,000 Tuition 0 : - 2 Rental of Equipment - : : 2 Annual Leave 1,000 1,000 6,000, Totals $5,200 3 6,000 4 37,000 $ 32,500 20. Description of Capital Equipment by Fiscal Year The Multichannel Data Acquisition System will be used to record Parameters such as temperature, salinity, D.O., and pH in the aquarium laboratory. Temperature Control and Cycling System will also be used in the aquarium laboratory to provide a controlled temperature setup. The microscope will be used for plankton, benthos, and fish work in the laboratory. The multi-parameter monitoring system will be used for physical sampling of Guayanilla Bay. The Op analyzer will be used for measurements in the mangroves of aid in making productivity assessments in Guayanilla Bay: ---Page Break--- oor rewai99 “2 foot used “5 pens soor He seaport “0 Dirks Soot $0 oxezaen °Y SietH6 9n7¥90330" 905 foe wee GuetL BuTaNIE fos foe ayer oot “e aanehe SUT GEC Ter BEE SEE PRT paaenag a mons ou y smauazav Fon at soppnag vor nETOR SURE, ---Page Break--- oyetle2 opa'eot

serine estat 60% 00% = ge Tot gon t O6e*S6t oggtort scenn gos‘tet BECK Wem Bien SEEM mor sarsoung s8uray Sbe2eng = Siete, ALR ‘SL=TEAL paUwsyEa" Jot Si=TE-zt vousyse Jos BT paTaRaT a, (-B,3u09) ¥ xauiaay ERP WORTeOT soroms wovanctog eure} ---Page Break--- serounoxionjaeds any uéeaBoywenays 50D “eo conf ye suseuoutays SUTPIOI0F onTL Zoaeu SprUTTes-ounyesodaoy Gara TEE BEBUTNDA JO L909 © ovay ---Page Break--- ---Page Break--- ---Page Break--- ---Page Break--- SCHEDULE 189 Additional Explanation for Operating Costs University of Puerto Rico ~ Contract No. E=(40-1)-1833 BUDGET FY - 1978 Oak Kidge Operations 189 No. 82 wove 5/14/76 1. Project Title: Health Impact of Hydroelectric Power Reservoirs in Tropics 2. Security Classification unclassified 2. Budget Activity No.: RP OL OF 4. Date Prepared: April 1976 5. Method of Reporting: Annual Report 6. Working Location: San Juan, Puerto Rico 7. Person in Charge: Willie R. Jobin, Ph.D. A. Project Continuing Effort 9. Man Years: FY-1976 FY-1977 a. Scientific 1.80 1.90 b. Other Direct 6.00 0.00 Total 1.96 0.25 1.90 4.40 10. Operating Costs: a. Direct salaries plus Fringe Benefits (from Appendix A) $ 29,800 $ 5,800 $ 35,000 $ 57,000 b. Overhead Costs (5% of a.) 22,300 4,400 19,600 42,000 c. Travel 300 2,000 d. Materials and Supplies 2,700 1,400 5,000 e. Other Services (itemized in Item 19) 4,700 Total $ 60,000 $ 15,000 $ 60,000 $ 100,000 11. Equipment Obligations: $ 7,000 $ 5,000 $ 5,000 ---Page Break--- sonny eames yopmuey oy soap mus hte yo fo ‘sonny yo tounge Ont eB wnt ‘2pcamony sn 29 soy cottatsasemaen, owmune encore Lame FE a on oat 001 Sronmy meg aan Jo mh EH ---Page Break--- Health Impact of Hydroelectric Power 189 w0, _ 82 Reservoirs in Tropics 15, Reports and Presentation, FY 1976 None 14, Purpose, Need, and Scope This study examines the ecology of existing hydroelectric reservoirs in Puerto Rico, in order to determine the factors which cause or prevent health problems related to the reservoirs. The major health problem investigated is schistosomiasis.

Methods will be developed for the prediction of the extent of disease transmission to be expected in new reservoirs being designed but not yet constructed. Alternate design of reservoirs and other preventive or control measures will be studied. In total, this project attempts to assess environmental and health impacts of proposed hydroelectric reservoirs and to develop methods to minimize that impact. New facilities for electrical power generation in the tropics and developing countries are primarily hydroelectric projects, with increased emphasis in the more industrialized countries on oil-fired steam generators. Nuclear power sources are further in the future. Thus, the largest single grant in the history of the Inter-American Development Bank was for the Salto Grande hydroelectric Project in Uruguay, and the major category in the Bank's 1974 loans for

energy production was for hydroelectric power. Power production in Africa has also centered on such hydroelectric projects as the Aswan Dam on the Nile, Katiba Dam on the Zambezi River, Kainji Dam in Nigeria, and the Volta Lake in Ghana. These dams and reservoirs cause immense changes in ecology, especially increases in diseases related to the proximity of man to water. In each of the African cases cited, schistosomiasis has significantly increased due to the construction of the reservoirs. Existing reservoirs in Puerto Rico are primarily for hydroelectric power and irrigation. The 25 major reservoirs will be studied for one year to select six that represent various ages, sizes, and levels of eutrophication. For the following two years, the six reservoirs will be studied to determine water temperature, volume and quality, algal productivity of macroscopic vegetation, number and species of mollusks, insects, and fish. Where bilharzia transmission occurs, it will be measured quantitatively. Available computer models for predicting water temperature, algal productivity, and mollusk populations will be calibrated with data from the first year of observation and then used for...

predict the second year. Field measurements will be used to validate the models for the second year data. These models will then be available for prediction on other reservoirs proposed for Puerto Rico and other ---Page Break--- Health Impact of Hydroelectric Power 189 No, _82 Reservoirs Tropics Caribbean sites. Available methods for control of bilharzia transmission will be studied for cost and benefits and the optimum measures will be specified to the Health Department. Modifications in original design will be evaluated for recommendations on future reservoirs. A proposal will be made to the power authority that some of the reservoirs in Puerto Rico for methods to eliminate the risk of bilharzia. Sampling Program In a recently published study by Jobin and Ferguson (1973) on 12 reservoirs in Puerto Rico which contained the snail hosts of schistosomiasis it was determined that populations of the snails could be quantitatively predicted on the basis of measured water temperature, habitat volume, and mass of vegetation or food, thus these factors will be monitored bi-monthly. Another recent publication by Jobin (1974) on the effects of water level fluctuation in reservoirs on snail populations had determined that drawdown of the reservoir water level at about 0.1 cm per hour vertically will strand the snails, exposing them to death by desiccation. Previous studies by the TVA showed that slightly faster drawdown rates of 0.4 cm per hour can be used to control the anopheline mosquitoes which spread malaria. Thus the field studies will make careful measurements of shore slope, water level recession, and snail and mosquito populations. The specific measurements to be made on the reservoirs will be: 1. Water level and reservoir volume 2. Water temperature in shore zone 3. Dissolved oxygen and productivity in shore zone 4. Physical stability of shore - eroding or stable 5. Shore slope and composition of soil 6. Extent of macroscopic vegetation 7. Snail populations 8. Schistosoma infections of snails 9. Patterns of human water

contact with infected waters 10, human fecal contamination of reservoirs LL. Insect population, especially anopheline mosquitoes 12, Turbidity of water 13. Extent of light penetration and zone of algal productivity (eek! eek) 14, Total phosphate concentration 15. Algae species and numbers 15, Relationship with other projects it is expected that the Puerto Rico Water Resources Authority and the U.S. Army Corps of Engineers will contribute substantially to ---Page Break--- Health Impact of hydroelectric Power 189 No. _ 82 Reservoirs Tropics the study since these two agencies own existing reservoirs in Puerto Rico and are constructing several new reservoirs. The Health Department is supplying a five-man field crew full time for the reservoir surveys. We highlight progress - FY-1976 A. Snail Surveys and Eutrophication As of March 15, 22 of the 25 major reservoirs have been surveyed by a joint team including personnel of the Health Department and P.R.N.C. Two of these were intensive surveys conducted with additional help from the U.S.P.R.,

Regional College at Cayey. In the other 20 surveys the primary emphasis was on water chemistry and snail populations. All reservoirs except 4 contained aquatic snails and these 4 were extremely clear lakes of low productivity. Biomphalaria glabrata, the intermediate host in schistosomiasis was found in Lake Carraizo, Lake Carite, Lake Pos Bocas, Lake Carzas and Tortuguero Lagoon. All are hydroelectric reservoirs except for Tortuguero Lagoon. The other predominant snail species were Marisa cornuarietis in 13 reservoirs, Tarebia granifera in 11 reservoirs, and Physa cubensis in 10 reservoirs. In all the reservoirs which contained Biomphalaria glabrata, at least two and usually three of these other species of snails were present. A large ampullarid snail, probably a species, was found in Lake Carite, Cidra Lake and Lake Carraizo. These reservoirs also contained large masses of floating water hyacinth and showed signs of eutrophication such as algae blooms and anaerobic bottom sludges. However,

Lakes Dos Bocas and Villalba were also eutrophied with water hyacinth but no Pe D. Hydroelectric components - Water Chemistry As a part of the first year survey, 2 to 10 samples have been taken from each lake for chemical analysis. The laboratory's current capability includes dissolved oxygen, pH, color, turbidity, chlorides, total COD, hardness, iron, nitrate, and total phosphate. When a field laboratory is available, total alkalinity and free CO2 will be added. The field survey of the lakes is almost complete; all of the analytical work should be completed by May and well before the end of the fiscal year. To date, analyses for 13 lakes (75 samples) have been completed. The lakes in general tend to be clean with low levels of phosphate and nitrate. Only Lachetti of Yauco had between 0.5 and 1.0 mg/liter of nitrates. It is interesting that Cidra Lake, which is known ---Page Break--- Health Impact of Hydroelectric Power 189 No. _82 Reservoirs in Tropics to be heavily contaminated and whose shore is overgrown with water hyacinth, has barely detectable phosphates and about 0.2 mg/liter nitrates. This would support those reports which suggest that the water hyacinth is effective in removing nutrients from the waters. Cidra Lake has about twice as much chloride as any of the other lakes, an indicator of contamination. Samples taken earlier in the year had very low iron content, while samples taken from sub-ecosystems during the winter had much more iron. This may reflect conversely previously stratified lakes. More studies will be necessary to verify this. At this time there is no obvious correlation between sampling and chemistry. The model prediction is in operating simulation on the U.P.R. computer. A mobile laboratory and boats have been prepared and will be outfitted with basic equipment in time to conduct the lake studies in July 1976. Vehicles to tow the laboratory and boat trailers have been requested. Expected Results - Transition Period 1976 A general review of the condition

of the lakes with respect to seceaghting Yetetation will be completed. The data Eros the fire Pests She Soo lia re Teutewed and atx reservotts selected for tatensive sven. IRE aebile Laboratory will be taken for one week to each resereore ees the first of 5 quarterly surveys will be completed. Expected Results ~ FY-1977 A complete annual cycle of 4 intensive Six reservoirs will be completed. Will be developed for each reservot for the next year (FY-1978). Expected Results ~ Fy-1978 A second annual cycle of intensive surveys on the six Esgervotrs will be completed. The observed snail populations will be setban tires igthe Previous coupurer predictions in order to verity the rejePAltty of the model. Appropriate adjustments will be made es oe ee cones tngralize it for predictions in any proposed reservoir. Methods and seeeeeuding enail populations in existing reservoirs will te eeweced and presented to the Power Authority for prelimisary evia ---Page Break--- Health Impact of Hydroelectric Power 189 No. _82 Reservoirs in Tropics scription and Explanation of Other Services: BY=1976 _TQ_ F¥+1977 _F¥01978 Power 82,200 § 5500 ° Shop Charges - - oe : Reproduction Charges 500 1,250 1,000 1,000, Transportation & Cormunicatton - 2 - Equipment Maintenance 500 1,000 = 1,000 Tation - ot ° Computer 1,000 1,000 1,000 1,000

‘Annual Leave - - : Vehicles 500 1,000 2,000 2,000 Miscellaneous : 2 : Electronic Charges : 2 ot : Rental of Equipment : 2 ot : Consuleane Fees 2 2 ot : Reactor Charges TorAL “$4,700 ~§ 7,800 $4,000 ¥ 5,000 20. peseription of Capital Equipnent by Fiscal Ys Pumps, flow measuring $7,000 $ = $5,000 $5,000 devices and plumbing for studies on vater Tevel fluctnttons ---Page Break--- "28 a9efoag 03 poxsoysueay ‘uoyaepunog 2019 UIT 61/s7/6 PPIREIS & ORT'LSS T66'ME § BEB"S ¢ TOBE ¢ rere Soorc Obey Ba tT saysousq 98uya2 oet*osg Testor § sit's $ gettez § Te203-4ng ore ey. = ae (ay) sesnuoq seuastayy 09€"6ys SEz‘ac $ SITs § Oz8'9r sopaeyes $9039 ee ra TUK ARGH ot ose SL/T/e peazeas 295 eauonoear] reuy 11 aueaezesy

“y2e1 stity == ~ oe 108 OpeuopLeR eOUETE *295 - TT “Z0sty “upy PROT TSTTIT oostz =~ - = ‘oot Paaujodde 9q 03 11 ‘20ssy yoavosoy ost, =~ - a oor pequyodde aq 03, 00°01 oootor = woot ospara uomaeg I] “2essy yaaeasoy = ~ 00° ssu/sz/6 paaaeas pot UefeuR *h wsaEH IT ‘20ssy 253;3U9198 ~ ~ tee"? “susst/eu oaettegeo eyazeH 1 aauys0ssy ‘eam secior seztor art's zuytoz uote wos lunoag “y puowiiey 1 3673u9}>5 JOpUAS 00*0TS dootor ¢ = “= $ -MOTREAEE UF x99 YOY “aos “uIgor “H GETTT TH peti hao TTS POIGAIP QL6T-AL LL6T-RE DIGI“AY 9LGT-AE sqzeuy "our on uoparsog _ __ v wramaay w ton 681 setdoaL s2y0A3090y tenog 273329, 90xpAH 30 2>edw1 yaIEOH ---Page Break--- 00's § ovo's § - saoyaep Suyansvom sory 9 edema *y usta Lust-as oueteas TE ‘on 6st uupustada 40 1800 @ xtaxaaav s9qdoay sxpoarssay 19s0g 9753201902pAi1 30 29edUT TOR ---Page Break--- ---Page Break--- ---Page Break--- ---Page Break--- SCHE DULE 189 Additional Explanation for Operating Costs University of Puerto Rico - Contract No. £=(40-1)-1633 BUDGET FY - 1978, ak Ridge Operations + Security Classification: Project Title; 2nvtronmental & Budget Activity Now: P= Date Prepared: + Method of Reporting: Ansual Pros Working Location; Rio Piedras, Person in Charge: Dr. Richard ¢ Project Term: cont imsing Man Years a. Scientific b. Other Direct Total Operating Costs: 2. Direct salaries plus Fringe Benefits (Grom Appendix A) b. Overhead Costs Travel Materials and Supplies fe. Other Services (itemized in item 19) Total Equipment Obligations: 189 No. Rev. 5/14/76 yrese Feport Puerto Rico Clenente Fysi976 PY-19TQ. FY-1977_EY=1978 - 0.38 on 2 = 2350 ew 1250 _ 25,000 2 ---Page Break--- Environmental Research Parke 289 Mo. __ 12. Publications and Research Progress None 13. Repor's and Presentations, F¥-1976 one 1s, Purpose, Need and Scope ‘This Program vill determine the feasibility of setting aside an outdoor laboratory where the inpact of man's activities on the natural enviroment, especially those related to enerty, can De assesses. Such @ program vould Incorporate the National

Prviron- mental Research Park objectives of (1) developing methods to assess and monitor the environmental impact of man's activities, (2) developing methods to estimate and predict the environmental response to proposed and ongoing activities, and (3) to demonstrate the impact of various activities and evaluate methods to minimize adverse impacts. 15. Relationship to Other Projects ‘The Program would become part of the National network of environmental parks that are being set aside to meet the objectives of the National Environmental Research Park (NERP) Technical Progress FY-1976 New Project Expected Results in FY-1977 During this year preliminary characterization of the site will be done including the preparation of soil and vegetation maps, compilation of a bibliography of research conducted in the areas, and preparation of a proposal to designate the site as a National Environmental Research Park. 18. Expected Results in FY-1978 Anticipated results will depend on the acceptance and findings of the Program as a National Environmental Research Park. 19. Description and Explanation of Other Services None 20. Description of Capital Equipment by Fiscal Year None. ---Page Break--- eon aypzous caus ston susie seqatres 28045 TTI eennodte sq 05 Coanty aoe set uur “208s 708 it EEE “sosey “T93 Set P astseres it aE gers jet = gerstorag sores SRT TRS CEE Et BRT TET a TE ‘oaesaey ---Page

Break--- ---Page Break--- ---Page Break--- ---Page Break--- SCHEDULE 189 Additional Explanation for Operating Costs University of Puerto Rico - Contract No. E=(40-1)-1833 BUDGET FY - 1978 Oak Ridge Operations 189 No. 65. Rev. 5/14/76 1. Project Title: Pikins 2. Security Classification: Unclassified 3. Budget Activity No.: RT 030 4. Date Prepared: Apes 1976 Method of Reporting: Annual and Monthly Reports Working Location: Mayaguez, Puerto Rico Person in Charge: J. G. Gonzalez 8. Project Term: Through FY-1977 9. Man Years: FY-1976 2. Scientific 2.10 b. Other Direct 2.90 Be Total 4.0 Las 4.70 - 10. Operating

Costs: 2. Direct salaries plus $39,000 $10,000 $47,000 Fringe Benefits (from Appendix A) Overhead Costs (56% of a.) 29,300 6,000 26,300 - c. Travel 9,500 1,000 54,900 - d. Materials and Supplies 8,700 5,000 10,000 Other Services 8,500 1,750 10,800 (itemized in Item 19) Total _$95,000 11, Equipment Obligations 36,000 == $2,000 : ---Page Break--- Bikini Project 189 No. 65 cae 1B. % Duplications and Research Progress Reports and Presentations, FY-1976 Purpose, Need and Scope Objectives of the Bikini Project are (1) To describe the distribution patterns of plutonium and americium in the marine waters, sediments and organisms of Bikini Atoll (2) To determine the influence of physical, chemical and biological parameters upon the movement of the radionuclides of these two actinide elements through the marine biogeochemical system. Although plutonium and, to a lesser degree, americium are among the most hazardous elements known to man, little is known of their interaction with the waters, sediments and biota of the nearshore marine environment. The production, use and accidental release of these radionuclides may be expected to increase from defense and peaceful technology, especially in the production of electrical power. Because of this, detailed information is needed concerning the concentration of these radionuclides into specific reservoirs in the marine environment or organisms which would limit their use by man. The scope of the project includes the description of the physical, chemical and biological processes which determine the movement of the radionuclides, Pu-238, Pu-239, Am-241 from the sediments of the weapons craters at Bikini Lagoon into the waters, plants and animals and the distribution patterns of the radionuclides in the components of the system. It also includes the transfer rates and distribution patterns of plutonium and americium through the water and sediments through specific planktonic, pelagic and benthic ecosystems. Relationship to Other Projects The Bikini biogeochemical studies of the transuranium.

elements Mere started as a cooperative program between the Laboratory of Sedimentation Ecology, University of Washington; Lawrence Livermore Laboratory, University of California; and the Puerto Rico Nuclear Center, University of Puerto Rico. Cooperation between the three laboratories has continued through exchange and comparison of duplicate analyses of samples and standards. In addition, Battelle Northwest Laboratories have supplied standard solutions of 1242 for determining chemical yield. 16. Technical Progress in FY-1976 The progress achieved thus far in our PRNC Laboratory is the following: 1. October-November 1974 Resurvey trip to Bikini A. Sediment Samples Sediment samples collected at 46 different stations were brought to FRAC laboratory where grinding, sieving and separation into fine and coarse fractions was performed. Both fractions were analyzed for plutonium content and gamma counting carried out. The scoring: Angel Pu85, gold, gulok meas pene TB, Me 060, Horizontal distribution patterns and nuclide ratios calculated for the transuranium alpha emitters. have been Sea Water Samples Precipitation of the ten 20-liter water samples collected during the 1974 resurvey trip was performed in our laboratory. Dissolution and analyses of the precipitates in order to determine Am and Pu content have been started. UW. Fall 1972 Trip As Sediment core Samples #2 core (bottom half of core) was analyzed to a depth of 207 cm. The core, 306 cm long (10. 84), was taken by the Seno Crater. Vertical profiles of Mo38, Al, Cs137, and Eu153 were determined. The whole half of this core was analyzed

for the above radionuclides and the results reported during FY-1995. 3. Fish samples Analyses of fish samples for the three transuranium radionuclides have been continued in order to get additional information to determine the mechanisms which cause the difference in uptake of Pu238 and Pu239 by marine organisms.

Bepected Resules in FY 1977 Plankton Samples The forty-five plankton samples collected in 1974 will be analyzed for the three transuranium radionuclides. The results will be related to the current patterns in Bikini Lagoon, the patterns of the same radionuclides observed in the other series of plankton collected in 1972, to the water samples collected in 1974, and to the distribution patterns of the radionuclides observed in the bottom sediments. Sediment core samples Analyses of radionuclide content in the remaining sediment core samples collected during the fall of 1972 in the Bravo, Toun and Zont Craters will be completed. At present, four alpha detectors are being used in our work. This limits the number of samples which may be analyzed because of the long counting time required. During FY 1977, we plan to buy two additional detectors to replace the damaged ones. Expected Results in FY 1974 project terminates at the end of FY-1977. Description and Explanation of Other Services FY 1977 By FY 1978 Power Shop Charges: Reproduction charges Transport and Com Equipment Maintenance Tuition Computer Annual Leave Utilities Miscellaneous Electronics Rental of Equipment Consultant Fees Reactor Charges $1,000 $6,000 $8,500 $1,750 $10,800 ---Page Break--- Bikini Project 189 No. 65, 20. Description of Equipment The two alpha detectors we plan to buy in FY-1977 are needed for counting the large number of plutonium and americium samples to be analyzed in the project. ---Page Break--- ~~ £29998 oF 0'ot 9stees avian 92's oath a outst a TEL*6ES 0089s mre 0330 “a = i = 70's s ~ seetz a oor's 1 “5 6 "9 H 000" 0s"r a0 sues a - sor 22 1/8 San0H F sossy “soy Tee's oestz/ Sosy *em ger's 54 0095 z9'e 086 c ose s20230H TE astaustos - RSIS BU6t-A3 LOTT OMS“ 9LGTOUd smmce GDI aie ROIEESO aL B -on oat v momaay a20foaa sania ---Page Break--- soju0aa99q9 oo ooo'zs =e poawr20sse pur s20a90a9p PydTe Ont, Bie Tea et WOPTTTISETT bususiaga 40 2509 4 momaey ow cer aeefera Tepe ---Page Break--- ---Page Break--- ---Page

Break--- ---Page Break--- SCHEDULE 189 Additional Explanation for Operating Costs University of Puerto Rico - Contract No. E=(40=1)-1833 BUDGET FY - 978 Oak Ridge Operations 109 No. 80_ Above 5/14/76 With Respect to Project Title: Epidemiological Models for Predicting Energy Related Facilities 2. Security Classification Unclassified 3. Budget Activity Now: R1 01 0 4. Date Prepared: April 1976 5. Method of Reporting: FRNC Annual Report Working Location: Río Piedras, Puerto Rico Person in Charge: William R. Jobin, Sr. D. Project Term: Terminates FY-77 % FY 1976 FY-197Q 178 a. Scientific 1300.75 1.00 ° b. Other Direct Costs: Total 2.25 0.75 1.00 ° 10. Operating Costs: 4. Direct salaries plus Fringe Benefits (from Appendix A) $28,400 $12,850 $20,500 D. Overhead Costs (55% of a.) 21,900 9,600 1,500 E. Travel 1,300 A A E. Materials and Supplies 6,000 250 5,000 F. Other Services (itemized in item 19) 38,000 Total $95,000 II. Equipment Obligations: ---Page Break--- ---Page Break--- Epidemiological Model 189 No. 80 13. Reports and Presentations, FY 1976 None 14. Purpose, Need and Scope In the development of new energy production facilities and in programs to reduce the pollution from existing facilities, planners need tools for predicting the environmental and health impact of these changes. Since the Puerto Rico Nuclear Center is in the tropics, special concern is given to tropical diseases related to hydroelectric developments which in Latin America and Africa have had considerable impact on schistosomiasis, malaria, onchocerciasis, and other parasitic diseases. More subtle diseases caused by air pollution from oil-fired steam plants also occur in tropical areas, especially in those undergoing rapid industrial development, and these also merit attention. The purpose of this project is to develop epidemiological models which can be used by planners to predict the changes in

disease prevalence and incidence related to the power facilities in Puerto Rico and other tropical areas. This project will be concerned

with laboratory and field investigations necessary for formulation, calibration, and verification of models related to specific diseases. "In addition, the completed models will be used to examine alternate strategies for reducing the related diseases in Puerto Rico and other tropical areas. The specific objectives are to develop a model of schistosomiasis transmission based on hydroelectric reservoirs as the epidemiological unit. The reservoirs in Puerto Rico to be modeled will include Lago Liza and Rio Blanco. In addition, a model will be developed for Volta reservoir in Ghana, for Taveras and Bao reservoirs in the Dominican Republic and for some of the larger power reservoirs on the São Francisco River in Brazil. The models will be verified with the field data and used to predict effects of various adjustments, operational schedules, and control programs for these reservoirs.

15. Relationship to Other Projects
The activities under this study utilize the biological data gathered in the Project on Hydroelectric Reservoirs.

16. Technical Progress in FY 1976
About half of the objectives have been achieved under the proposed modeling program, in accordance with the limitation on funding.

A. Simulation Models for Schistosomiasis around reservoirs
The logic and Fortran IV programs have been obtained for ---Page Break--- Epidemiological Model 189 No. 80 @ snail population model, a mammalian population model, and three schistosome transmission models. The snail model has been brought up to operation on the U.P.R. computer.

Skin Test Survey
Preparations for the 1976 skin test survey for bilharzia have been completed. The survey begins in April and will terminate in mid-May. An optically-scanned data sheet was prepared for each of the 20,000 school children to be tested. The data sheet was designed in consultation with the U.P.R. computer center for rapid processing of the large amount of epidemiological data being collected. A computer program was developed and finalized to process the data directly from the optical scanner.

tato tables for comparison with the previous skin teste of 196) and 1969, 1T prevalence of biIharri To carry out the testing program in the schools, arrangements were made with the Department of Public Instruction for statistical information and coordination with individual teachers. A randomized 25% sample of 5th grade classrooms was selected from the present school system and scheduled for testing in April and May. Arrangements were completed with the Department of Health for six nurses to do the testing with assistance from other regional personnel. All materials including antigen and disposable syringes have been obtained. © Summary of Available Epidemiological Data for Puerto Rico Available epidemiological data has been summarized for 5 small communities in Puerto Rico where schistosomiasis transmission has been very intense in the past. Data and maps are available on human populations, infection rates, and snail populations. Detailed information on all aspects of transmission is available for these five. In addition, the entire island has been divided into 12 zones and basic information on sanitation, human population, and schistosomiasis prevalence has been summarized in tabular form. 2. Epidemiological Data for

African and Brazilian Reservoirs During the year, site visits were made to Volta Reservoir in Ghana and Tres Marias, Fornas, and Volta Grande Reservoirs in Brazil to gather engineering and epidemiological data. Data summaries were also obtained for Lake Nasser in Egypt, Lake Kariba in Rhodesia, and Zable, Kazou Lake in the Ivory Coast and Lake Kainji in Nigeria. Field surveys of Taveras and Bao Reservoirs in the Dominican Republic will take place in June 1976 to complete the international data gathering. Of these 10 hydroelectric reservoirs, the most complete information is available for Volta Reservoir in Ghana and preliminary modeling was completed on one phase of schistosomiasis transmission in the African arm of the lake where an epidemic of Schistosomiasis occurred. ---Page Break--- Epidemiological

Yodet occurred soon after filling of the reservoir, was analyzed on dispersion of schistosome aitaci £0 snail populations, and a comparison was made 189 wo. 60 Field and laboratory data dia and cercariae, related between the effects of a chemotherapy program and a snail control program. The simple model analysis showed that the snail control program would cause a much greater decrease in incidence rates for local inhabitants than would the chemotherapy program. Expected Results Transition Quarter Dependent on funding - see original proposal Expected Results FY-1977 Dependent on funding 18. Expected Results FY-1978 Dependent on funding 19. Description and Explanation of Other Service Budget FY-1977 FY-1978 Terminates ” Power Shop Charges Reproduction Charges Transportation & Communication Equipment Maintenance Tuition Computer Annual Leave Vehicles Miscellaneous Electronic Charges Rental of Equipment Consultant Fees Reactor Charges 1,000 250 Total $1,050 $3,000 $38,000 20. Description of Capital Equipment by Fiscal Year one a ---Page Break--- ---Page Break--- SCHEDULE 189 Additional Explanation for Operating Costs University of Puerto Rico ~ Contract No. E=(40-1)=1833 BUDGET FY - 1978 Oak Ridge Operations 189 No. 79 Feb $/14/76 1. Project Title: Effects of Rose Fuel Pollutants on Human Health and Biota in the Tropics 2. Security Classification Unclassified 3. Budget Activity Now: RE 01 01 4. Date Prepared: April 1976 5. Method of Reporting: Annual Report 6. Working Location: Río Piedras, Puerto Rico 7. Person in Charge: William R. Jobin, Sc.D. 8. Project Term Terminates FY-77 9. Man Years: a. Scientific 10. b. Other Direct Total Operating Costs: 4. Direct salaries plus Fringe Benefits (from Appendix A) $39,400 $6,600 $20,200 b. Overhead Costs (56% of a.) 29,600 5,000 11,300 c. Travel 1,000 500 - Materials and Supplies 3,000 3,300 - Other Services (itemized in Item 19) 4,000 700 Total $97,000 $24,250 $40,000 Equipment Obligation ---Page Break--- ---Page Break--- Schedule 189 Additional Explanation for

Operating Costs City of Puerto Rico - Contract No. E(40-1)1833, Budget FY 1978 Uni Oak Ridge Operations 189 No. 71 Project Title: Marine Research Ship Operation Rev. 5/14/76 Security Classification: Unclassified Budget Activity No.: RF 03 04 Date Prepared: April 1976 Method of Reporting: FRNC Annual Report Working Location: Mayaguez, Puerto Rico Person in Charge: J. G. González Project Term: Continuing effort Man: e1976 Y= a. Officers 1.00 0.08 - - b. Crew and support 609 oe Total 7.49 0. - - operating Com 4. Direct salaries plus $79,900 $3,200 - : Fringe Benefits (From Appendix A) b. overhead costs 59,900 2,600 - - c. Travel 3,500 2,700 - - 4. Materials and Supplies 8,000 - - : e. Drydocking 25,000 : - - f. Other Services (itemized in Item 19) 40,700 + Boat Rental Total $317,000 Other Credits $21,000 TOTAL $785,000 11. Equipment Obligation: $11,200 - - - ---Page Break--- Marine Research Ship Operation 189 No. 72 2. a. Me 1. 16 7 18. Publications and Research Progress None Reports and Presentations, FY 1976: The research vessel, R. F. PALIMBO, was built for the ERDA in San Diego, California in 1970-71 and was brought to Puerto Rico in the spring of 1971. The ship was built to carry out Oceanographic research by the Marine Ecology Division of the Puerto Rico Nuclear Center. The PALIMBO will be transferred to another ERDA sponsored laboratory before the end of FY 1976, therefore other plans

must be made to carry out the research mission of the Division. Relationship to Other Projects Not applicable Technical Progress in FY 1976 Not applicable Expected Results in FY 1977 Boat rental funds are requested to charter any of several available boats in Puerto Rico to carry out the research missions associated with the Marine Ecology Division program. The Division estimates a need of approximately 120 days per year at a leasing rate of $250-350/day. The possibility of purchasing a research vessel from the PRIRA is being explored since it appears that the cost of operating 2 45" which would be adequate.

For the research needs of the Division would be less than those incurred in rental or leasing. Expected Results in FY-1978: Not applicable ---Page Break--- Marine Research Ship operation 19, 20. Description and explanation of both Power Shop charges Reproduction Charges Transportation and Communication Equipment Maintenance - Tuition: Computer: Annual Leave 1,000 Vehicles Miscellaneous 5,000 Electronic Charges 1,000 Rental of Equipment - Consultant Fees 7 Reactor Charges: General Expenses (fuel) 29,500 340,700 Description of capital equipment by Fiscal Year None 189 No. 6,000 n ---Page Break--- aviary sanitation aura jeaqns AranoH oot wor oot sano ‘oot Ay a00% 200% Amount ‘woot ‘wor 00s osu's 00 - oct*9 ‘wor 005 '« ‘toot sovte oor ece'ts oooters ‘00 uyerdeg aos Ay z0uy5u2 bust-xa Suse Sy SORT ‘ae Nora S08 TZ ‘on oot ---Page Break---