

PRNC221

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 Feology Progsam

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---

Qak Ridge Operations

ML

2.

3.

4.

8.

ne

+ Broject 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: Terrestric? Ecology

Security Classification or Project: inoleseirica

Budget Activity No.: =2-03-01

Date Prepared: April, 1976

Method of Reporting: jnmial Progress Report

Working Location; iio Piedras

+ Porson in Charge: or. Richard G. Clenents

sng Before

Man Years: EY-1976 FY=I9TQ. FY-1977

a. Scientitte 5.0 1,003.95

b! Other Direct 85 elo 235

Total B5 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

©. Travel 2,000 1,000 4,000,

4, Materials and Supplies 12,600 3,305 13,100

. Other Services

(Itemized in [tem 19) 19, 300 5 _ 22,900.

Total 275,000 __62,900 250,000

Equipment Obligation:

20,000 = 20,000

Fx1978

5.95

12.95,

18.90

190,277

106, 535

8,000

21,730

27,458

ea00

20,000

---Page Break---

?weap wmMsIND f wt x x x |

tay an

macect| | l

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

awwvnr *

anu owv wouvariens

eeu Hoy yraeany

---Page Break---

(ses 6606

(5161) °Ps 1-4

ume Atoeg mein

---Page Break---

awnyor

Sssupous Houvaszy aw woUvaNand 2

song Ato3 munsuDg

---Page Break---

---Page Break---

Terrestrial Feology Prvicran 289 Mo. 22

13. Reports and Presentations, VY-76

Clements, R., E. Cuevas, C. Cnlén, A. Estrada and 7. deasio,

19M. Terrestrial Beology Fthdice of the HORCO-? Site,

Telote, Puerto Rico. UBARC Docket Ho. 50-376, cap. 2.7,

BMRA

db, Cuevas Be Chances in Selected Water

Quality, by Land Use Patterns in

the Espirit Santo Mrainare Pasin. PRIC-295, 70 pp

cr Block AM. ad 2 ements, 17%. Yre-cperet ional Nonitor-

iy for 1080-1 S125, Telote, Puerto Rico. eh!

No. 500375, Chap. 6.3, FAVA.

ish, 197, Nadiolorseas

ABC? Dosket No. 50-276,

Block, Ad 5. o. clemontss and =. Pan

Backgroun? Data for fierto Rico. Ut

Chap. 7.5, PRR

2, Block AML, ¥. Santos, Ro. /

LiNS. "Thermo Tumine-cenge Boeinet

Riec. PRC-19

a, and M, Banus,

in tortmest. Fueso

2h, Purpose, Heed and Peone

?The muese of the Fepirits Panto Drainuze Racin Prosrn is
twofel: (1) to provide baseline ecolorieal data for Awure or=
viromental asse-ment studies at he loea? aul rections) Tevel
and (2) to wetemine through @1 veosyetem aoprogh ganaenent. AIX
temmatives for the wise utilisation of ener-y, water and land
Fegources. ?The study wil deseribe the interrelattonsh
Climate, vogetativn, aninaze, softs ant man and their combined
influence upon the ydrorogit cycle of the arainace basin beth at
?he Yocal ani rep ional v

dereil as roinal in size Gince 1b encoupasses the oricin of the

wolvee planniar and decieson making

and botk of these regulre data. At recent, little is know about
?the intomorkines of a complete, Integrated system such az the
Grainace basin. White wy teclated, ecologically oriented studies
have been condicted in a tropical enviroment, few, if ary, have
provided the data base requires for, environwental sanageneat. Tn
view of rapidly chansiny soctocoonrmis eanditions ant maciral re.
sources Limitations, sanagencnt urzenti y requires input deta from
three systems: {1) the piysical (govlogieal-neteorslesical), (2)
Biclocion! and (3) cultural. This integrates stucy has been
Aestencd to provide these data. The seope cf the Program wil)

deal with the lytiroloric eycle as it de affected by the interactions
of the physical, blotogical and cultural systema. Tt will be mlete

---Page Break---

Terrestrial Ecology Program 189 No. 2

WS.

16.

Bisciplinary and utilize the top-down 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

The use of the drainage basin as a unifying concept has been and is being carried out at other locations such as Doolhaven, Stanford, and Holifield National Laboratories. The development of

4 complete drainage basin study in Puerco Miedo 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 Telesy Program of F.R.N.C. has been programmed. Where feasible, cooperative research will be developed between both programs.

Technical Progress in #Y-76

A. Research Activities

Relationship 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 been in each of the above areas and are summarized in the following paragraphs.

1. climatology

a. Rain Gage Network

A network of twenty storage rain gage stations have been installed in the forested region of the upper Espiritu Santo

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 gages that will be re-

quired 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)

---Page Break---

Terrestrial Keology (roeran 289 tio. 2b
theoretical. In the aSrect appr caldvred
aealnst an Eppley Suectval Tyeuaster arc tei used to
provide estinates of solar innut to the area. hile these
instrunents wi1l provide data for the energy Whit, Oe the=
orotteal approach wii adiust jor slope ane ame! cowittions
A oummter ie Yast oy veiadtnt she

vig area and pry the elie sa aepeet of
the gouty area ban te ot ime es tuted

wilt seine and oe Solar Inpit autor
ined ony P the oun ?hroughouts the
year. Yates will chur ve aha

boraing to aeois he onerey
inuaret

rth: Sante "rains
swior amare of soLlutan
Phorse part isvlate
ascline Liw'e
eu be mas. This

fewnwind rom any
oy Susie provide
rresetlets gecren ure accesenents
vest ad ?tho Getermine

ation of the contribution to the

terrestrial and atmospheric

Survey of Rio Heninty Sante

The purpose of this survey characterizes physical

and chemical properties of the system and to describe the

flow and level. The survey has been divided into two parts.

The first will cover a detailed description of the river system,

namely Quebraia, Quebrada Conaiora, Quebrada Gramie,

Mo Faptrity Caste and its tributaries. The second will be a

comparative study. The data obtained will serve

the immediate future.

ve

to Sdent tzy tho vesoarah srfort: ive

he surveys have Leon: eomprotee vith the reception of water

chentetry. Tears aes Win periured.

Dd. Bioassay of Come Freskvater occaped Crustaceans

Elght species belowing to tie Fed Mes, Atyidue, Palac-
monidae and sevlotleipiuctdue ?re bon observa! ant reported

In the io S.pieitu Canto and d* tettritariee. Very sete de

known of the bivlowy 9? 0 Hpflotccers esmae

Hifvons, belomine te an! !y (ophistine Tietts ats

istribution ti. freshwaters, 1* ome loon ouseasta that &

narine phase! nusessary vor th sa2 and Palaenon-

However, prelirinary = That fe

may Se possto.e tor she seuers = raullice to coumlete

their Life cycle 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 determine the role this mollusk plays in the ecology of Rio Espiritu Santo have been initiated.

Influence of Physical-Chemical Factors on the Distribution of Freshwater Shrimps in the Espiritu Santo River.

This study was designed to study the distribution of shrimps in the upper Espiritu Santo River and correlate the distribution of each species with various physical-chemical factors.

3. Aquatic Insects

a. The Role of Caraculus

saraco})

in the Forest Ecosystem

The role of this snail in the detritus food chain is poorly understood. It is known to have diverse feeding habits including mosses, fungi, leaf litter, leaves and fruit. The purpose of this investigation is to study the ecology of this snail and its role in the dynamics of the forest ecosystem.

b. Population

on Dynamics of *Caracolus caracolia*

Currently underway is a study on the population of *Caracolus caracolia* at three different locations to study the effect of vegetation type and cover on the population levels. This study

Will complement the investigation described in A above.

L, Plant, Reotozy

4, Succession and Regrowth following Irradiation in « Tropical,
Forest.

This project is compiling the census data of the last ten years on the succession and regrowth of vegetation in the irradiated site at FI 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, 1973 and 1975 have been transferred to TI 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.

Final report should be available by the middle of FI-1977,

5.

---Page Break---

?Terrestrial, 169 We. 25

» Le Sper Sumstettas Sa

The research vrcpawal tor ?te proseet \$s mew io the Cina

stages of pruvaretion, Ts wi'l tye" the clasp siaut'e

Aesertption <2 awn! epi nave 7

treet of sat th : te

the bese dep io momma ot tte.

am 1, end

. oe Hee at tempi

to prepare Ira : teas 4

Slnttty ine an compet ton

bevel, wr Ration ar

Baced Li onreervatte

Service, 8 2 11h ha,

been prepa 4 tn he

sees and scenmied

Uy each ty

Te lydrology

sits aren 2 Rai Ye sedtty the

existing g2riae 4 elt Siete koe Lo Poet the

Reasurement of etrewifiw Me ojo yemut e's witoring ctrome

Slow ig on band, "inact sae rs esecny Col HcaLione could

Pye wet ttt add hae Sore arsine

eheary pled: Hew Howe Aetudy 40

dororsine the actu, fo uidity Ve exten 4!) be completed

this year,

Be Rauralton aut 1

arch activitic ies the wampbel fen of

hence tothe Tlvercity oP Puasso Phew

anda Thal!» eineerati ity. neh dureatt=

vations wre initiates once? 2 ia ology

Iniversity or eit ie dale BEG

Prot

: esemee, Ut

---Page Break---

Terrestrial Ecology *Forsman* 189 No. 21,

Elvira Cuevas "Changes in Water Quality

as Influenced by Land Use

Potters, 1.8. Molo,

University of Puerto Rico

16. Chamonts, ERNE

John R. Lamij "The Influence of Physical

Chemical Factors on the

Distribution of Freshwater

Shrimps in the Espiritu

Santo River. M.S. Biology

University of Puerto Rico. R.G. Clements, PRIC

Pedro Cebalero Limiting Factors Affect

ing the Distribution of

Garacolus caracolia in the

Espiritu Santo basin. M.S.

Biol., University of Puerto

Rico. R.G. Clements, 7c

Marfa 1. Lebrén Recovery and Succession

of Plants Following Gamma

Irradiation of a Propteris 2. MeConatek, Univ.

Fair Forest. 9.5. Dies of Tennessee

dissertation, Univ. of North

Carolina. R.G. Clements, PREC

Construction of the new laboratory facility at El Verde de still pending

and now scheduled for completion in early FY-1977.

AT. Expected results £71977

The Program will continue to develop the major research areas set forth in Item 15. Upon completion of the surveys and preliminary investigations initiated in 1976, the staff will review the results during 1977 and propose definitive research investigations for FY-78 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 Senter. These stations through a wetter sensor system will provide daily information on rainfall, temperature and solar radiation throughout the area.

Completion of the vegetation survey and mapping of the forested area of the upper Sepiritu Santo in 1976, 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 colle associated with sack vegetation type

In Limotogy, work will be expanded on the population dynamics and feeding habits of the crustacean?, More definitive studies sili be undertaken in the estuary, ?This vill include the identi feat son

?These comleted a

---Page Break---

Terrestrial Ecology Progran 289 No. 22

op the species of fish that inhabit this portion of the river, the physica? and chenieal properties o2 the water and seliment snelysis 1 fa necessary to establish the baseline conditions of this see- ent as carly as possible because the alidle section of the drainare asin ie undergoing rapid chanves and aubeeqent impacts will be refleciod in this part of the -ys-on,

veining 4m $P_i=77$, the shyed

soil types present will be inizistoe. Bul samples wii? be ccl-

lected from eack of the majer Herirene and determinations e131

inelude, cation exchange cazacity. vercen base axturat voy ma/or

and minor elements, water howeins oavacivy, wfsturs deveretion

curves and BUI density.

entea? anetyeis of the

lydrologsea) studies on te ispbrity Santo ave dopentent

pon evailanility of Ande. cei.

he work on plant aa

released as a PRIC publicis

18. Expected Results tn FY=W2

?Yhe Program will continie to guldolines set

forth in the Pesenron ian ané Tics 16, A© the ont of S-77 we

Will review internally the nracroes at re the coals ent

forth in tho Resiarch "an. fe wil et an cexternat review

of the Program ant It wil? be modi ooupaated iy meet the

needs of HIDA.

shop Charges

Reproduction Charges

?Trans, and Comm,

Baupaent tiatntenance

?Tuition

Computer

annual Leave

Yehteies

Eiscett eras

Fleetronse Charges

Rental of Squfpeent

Consultant Fees

Reactor charges

?rota!

---Page Break---

Terrestrial Eeology Frogran 289 Wo. 22

20.

Description of Capital equipment by Fiscal Year

Expenditures for FY-1977 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 field work in the mountainous areas @ repeater station for our present radio network will be purchased. This will enable field crews to maintain communication with the base station at all times in case of an emergency or accident. Tight weight aluminum crane towers are required for the permanent installation of our rainfall, temperature, solar radiation and network in the research trees. Smaller items totaling \$4,500 will be purchased to support on-going research.

In FY-1978 we are programming the establishment of a weather station at the El Verde site and will require the acquisition of

& solar Integration integrator, wind monitoring equipment and a net
Yalometer, Increased staff and research activities require a
programable calculator, X-Y plotter to replace present calculator
which is now outdated. Miscellaneous items to support field research
will total approximately 5,09.

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°

suuametrnbs SupZOyTUOH DUT

soyRsTOVUL WOFARTOSUT WLS,

(e) WH drs fexepsc00H

?Su93] SRODUETLOOSTA

(L) sanog quoumaysur

: quongay, uoygeo penn uoraerS ?zayEadet

- x9qimay) TENEUMOTALAL

? "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: Mayaguez, Puerto Rico

7. Person in Charge: Dr. J. G. Gonzalez

8. Project Term: Continuing Before

9. Man Years: FY=1976 _FY-1979

a. Scientific 1.65 Tat 9.ur

b. Othor Direct a3 sca) 28.00

Total «13-91 3.02 ase? 17.47

10. Operating Costs:

a. Direct salaries plus

Fringe Benotits

(from Appendix A) 151,300 52,200 163,900 227,

b. Overhead Costs (56% of a.) 113,500 29,000 91.800 17,200

©. Travel 8,000 7,000 00 8,000

d. Materials and Supplies 13,300 18,100

fe. 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. Reports and Presentations, 76

Vicente, Vance P, . Benthic Invertebrates of Punta Higuero

Puerto Rico Environmental Studies, PRO-174

Vicente, Vance P. Benthic

Communities of Puerto Rico

Ecological Aspects of the Sea Grass Com-

6

Kinoshita, J.J., R. Castro and P. Davis, 1975. The Fishery of Puerto Rico

Working Paper Report. PHAC-1°S

Kinoshita, J.J. A Survey of Fishes from Barrio Islote on the

North Coast of Puerto Rico, 11th. Meeting of the Association

of Island Marine Biologists Conference, St. Croix, Virgin

Kimmel, J.J., 1975. A survey of Fish
North Coast of Puerto Rico. WSARC Docket K
PRRR

from Barrio Tslote on the
50-376, Chap. 2.7

Novtsonery, J.) 1975. A Linear Regression Model of Dis
solved Thonganie whoo at the River, Norfolk,
Virginia. Paper presented at A.S.8.0. Conference, Seattle,
Washington, Dc

Montgomery, J. and F.J. Sartianc, 1975. Ionic, Particulate and

Orcande Forms of Za and Cx in the Guanafivo Piver and Coastal
Zones. th, National Symporiun on Fadicecology, Corvalis,
Gregon.

Montgomery, J., \$. Kolchmainer and M. Bemis, 1975. Tndtviduel
Variation of trace Meta! Content an Fish. Nat. Bur. of
Standards - 7th. Mat. Fes. Cymposium, Gaithersburg, Hd,

Monugomery, J. et. al, 1/75. Leaching of Heavy Metals from
Secondary Treated Sewaze Siudve by Sea Water and Possible
Yathways in @ Tropical Marine Fcosyster. Tnternat\$onal Cont.
on Heeny Metals in the Environnent. Ottawa, Ontario.

Nutt, .E., 1975. Zooplankton
Enviromental Studies, Pi

bodies, 1974, in Tortuguero Bay
?181, pp. 19455.

Mt, ME., 1975. Zooplankton Studies 197 in PL. Manat{ Environ=
hentai Studies. PAWC-122, yp, 51-56.

Nutt, M-E., 2975. Zooplankton Studies 197 in Pt. Hguero Environ
mental Studies. PID-132, pp, 51-56.

Wut, KE., 1975. Yooplankion Studies 197Me75 in Islote Environ-
Sental? studice, PRIDA190.

Itt, HAB., 1975. A Yoar Zo

Boast ?oF Puerte &

Ste Croix, Val.

Study of Zooplankton from the North

caper presented at A.TAMLL, of Carsbbean,

---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 Tatiavoa 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 like 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 the Guayaboa Bay.

An integrated team approach will be used to investigate the interaction of physical, chemical and biological systems in the Guayaboa/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 contained 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.

16. 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---

?The purpose of the papers is

each of the areas as it relates:

to summarize what is known in

to the study area, Based upon this

Waovioig» needed research investigations will be identified and

assil

ned priorities within the integrated plan. Presently the

ra are being reviewed internally by the staff? and when completed

*All be sent out for outside review, Tt Le anticipated that this

Document will be ready by the beginning of FL-1977~

4 retention of three in the scientific staff has forced the re~

organization 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 on energy related pollutants and physical oceanography of Guayaquil 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 Guayaquil Bay ~ Talloa 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.

3. Yangrove Beology

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 this mangrove there are scores of man-made ponds which receive waste discharges from the energy complex, smoke from flare stacks and waste chemical burners 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 maximum 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 sea water, 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 of 33-35°C, growth and survival of seedlings was comparable to the control areas. These studies

should be repeated under controlled conditions in the Aquarium

to show recovery

2, rare Metal Uptake by Mangrove Seedlings

The purpose of the study was to determine the uptake of

Vanadium, tin, Zn, Cd, Pb, and Cr by young trees from polluted

environments. The study also will determine where in the plants does

concentration occur. Seedlings were grown in tanks enriched with sewage sludge and levels were compared to seedlings growing at 4 different locations with various burdens of the trace metals. Preliminary data indicate levels of Cu, Zn and Pb in the vicinity 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 and 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 &
duration of approximately two years. Its objectives will be
to determine the effects of thermal and chemical stress on
the rate of detritus production and its nutritional content.
Litter bags will be used to evaluate the rate of detritus
formation, intensity of grazing, population of grazers and the
material will be analyzed to determine the change in nutrient
content and the accumulation of trace metals.

Knowledge of the Guayantilla-Tataboa areas were
obtained 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 grain
samples of the surface sediments were also obtained at all stations.
In situ determination of temperature, salinity, dissolved oxy

and 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, Cd, Cr, Ni, Pb, Hg and Fe on water and sediment samples. The distribution

of these elements with depth at the various stations have been

Generalized with regard to the various physicochemical forms that

exist in the aqueous marine environment. The analytical techniques

used included Anodic Stripping Voltammetry, the Heated Graphite

Cathode Stripping technique and other flame Atomic Absorption

Spectroscopic 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 TOC,

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 perchloric acid digestion were performed, to determine total metal distribution as a function of particle size in the surface sediment. These size fractions were further characterized for the readily available content of trace metals as defined by leaching with a reducing dilute acid solution. Flame atomic absorption spectroscopy was used in the determinations. Data reduction and analysis: (0) arbitrary

D. High Blotogy.

1. A Survey of the Fish of the Guayant2ia Bay

Beginning in July, 1975, a survey was initiated to collect
gad Adentizy the Toh? cound? in the ?uayantliacTallabes, Say aceas,
in addition to the identification, neagurenenea were taney
densth, » species, sex spawning condition, ?and food habit,
Duta were also taken vn'temperature, salinity, habitat, and
spatial and temporal, distribution. "he data will be subjected
tom correlation analysis to determine the interrelationchin
between the variables neasured ana the pollution and/or etecas
levels found.

Plankton Btozogy

The bicmacs, sbuninnce, and species composition of zoo
plankton in Guayanitia Bay have been nonitorel sonthiy since
eptenber, 19/5. Keculte fran this survey show the copepod
Acartia tonsa to be clearly the most important soonlanmrs
fom in the shallow areas or the bay. Field en laboretory
gesearch has therefore been initiated to investivate the eee
fects of therma? stress on this organian. Vita? staining tech-
niques were voed to estimate the percentace 02 1
copepods in thecrally pollites areas of the bar.
nureival, respiration, and excretion experine! ?sare being

carried out in the laboratory to evaluate the effects of cle
weed temperature on this cpepod. ?This wors vill be sompieved
during PY-1 04.

---Page Break---

Marine Pollution Studies 189 No. 1

Fe Marine Geology

Sediment samples have been taken from Talloa and Cuayanilla Bays

in order to study the living and dead foraminifera, one of the

purposes of the study of the foraminifera is to use them as biostratigraphic

indicators. The number of foraminifera, the species and the

species diversity is being determined for this purpose. Biostratigraphy

As so being used, the results in Talloa Bay indicate that dwarf

populations of *Ammonia satyris* have developed and it consists

a unique feature in the waters surrounding Puerto Rico. Some

genus and species are so deformed that they

cannot be identified. Zonations of other foraminifera appears

to be total,

Living specimens of *Amonie satvebyana* have been collected and bred in the laboratory. The test morphology of this foraminifera is strongly affected by environmental conditions. Different forms of this species occur around Puerto Rico in arcs submitted to different pollutants. The laboratory specimens will be submitted to different pollutants to determine their effect in the test morphology.

SG. Honthfe Rioters

The 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. These studies will determine the species composition, species diversity, biomass, zonation, pigment composition and

phenotypic variations in each community.

17. Benefited Results in SY-1977

Only those projects that have a direct relationship to the new research plan now under development will be continued. The master research plan which will order the institutes research effort over the next five years should be ready for review by SHR in early PYe 1977. Some modification of this plan may be forthcoming with the appointment of new Director of the Program.

Primary emphasis will be given to the collection of physical chemical and biological data on the Guayanita Bay area. Analysis and interpretation of physical oceanographic data is scheduled to begin in January, 1978 with the appointment of a Physical Oceans Researcher.

It is now anticipated that the sea-water aquarium will be fully operational by early SY-1977.

ous

---Page Break---

Marine Pollution Studies 189 to. 13,

16. Expected Results for 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 Guatemala 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.

FeAge Pugme RT age

Poser 10,500 7,600 13,000 23,000

Verteles 3,500 "5m 5,000?, 000

Equip. Maintenance 21500 90 too «3500,

Stop Tharges 1,600 - - -

Brectrenie Charges sono = . :

Reproduction chanyes 2,000 2,500 2,000,

Comiter 1000500 2)000 2000.

Consultant Pees ?Boy - - :

Miscellaneous 6522 500-2400) 2,000,

Transg. & Com, 1,500 00-2500 21.000

Tuttion 0 : - 2

Rental of Equipment - : : 2

?Arumal Teave 1,000 1,000 6,000,

Totals \$5,200 3 6,000 4 37,000 § 32, 500

20. Description of Capital Fauipeent by Fiscal Year

The Multichanicl Data Acquisition System will be used to record

Parameters such ac temperature, salinity, D.1., and pi in the

aquirium leicratory.

Semperature Control and Cyoling System will alec be used in

aquarius laboratory to provide s controlled temperature set up,

?Wie wleroscope wilt be used tor plankton, venthos and fish work in
tle laboratory.

?The miti-paraneter nonitorin; system will be used for physical
ling of Cuayanilie Rey.

The Op analyzer will be ?eed +
?furemefits In the mangroves of

aid In making productivity wen-
fuayant ie 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, Projwot Title: Meathh Inpact of Hydroelectric Dower Reservoirs in Tropics

2. Security Classification unelassi fied

2, Budget Activity No.: RP OL oF

4. Date Propared: aprt1 1976

S. Mathod of Reporting: Annual Report

©. Working Location: fo Piedras, Ruerto Rico

7. Merson in Charge: wilitee R. Jobin, Se. D.

A. Project Continuing Eefort

9. Man Yoars: Ey-1976 FY-19TQ Fy-1977

a. Sciuntutic 1800.25 1.90

b. Other Direct 6 09 00

Total 1.96 0.25 1.90 4.40

10. Operating Costs:

4. birect salaries plus

Fringe Banctits

(trom Appendix A) \$ 29,800 \$5,800 \$ 35,000 § 57,000

Ys Overhead Costs (5% of a.) 22,300 4,400 19,600 42,000

©. Travel 300 ° 2 1,000

d, Materials and Supplies 2,700 ° 1,400 5,000

©. Other Services

(tomized in Item 19) 4,700

Total \$60,000 \$15,000 § 60,000 \$100,000

11, Bquipment 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 wo, _ 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 prediction of the extent of disease transmission to be
expected in new reservoirs being designed but not yet constructed.
Alternate design of reservoir: and other preventive or control measures
Will be studied. In total this project attempts to assess environmental

and health impact 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 proximity of man with water. In each of the African cases cited, schistosomiasis has significantly increased due to construction of the reservoir.

Existing reservoirs in Puerto Rico are primarily for hydro~
electric power and irrigation. The 25 major reservoirs will be studied
for one year to select six which 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
to 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---

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 owns 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. Schistosome infections of snails

9. Patterns of human water contact with infected waters

10. Human fecal contamination of reservoirs

11. Insect population, especially anopheline mosquitoes

12. Turbidity of water

13. Extent of Light penetration and zone of algal productivity (eucalyptus)

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

hi

Health 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.NC. Two of these were intensive surveys conducted with additional help from the U.S.P.H., Regional College at Cayey. In the other 20 surveys the primary emphasis was on water chemistry and snail populations. All

Feserwoirs except 4 contained aquatic snails and these 4 were extremely

clear Tikes of low productivity. BMonphalaria glabrata, the ineermedi
host in schistosomiasis vas found in Lake Carraizo, Lake Carite, Lake

Pos Bocas, Lake Carzas and Tortuguero Lagoon, All are hydroelectrie

Feservoirs except for Tortuzuero Lagoon.

?The other predominant snail spectes were Marisa cornuarietis
in 13 reservoirs, Tarebia granifera in 1] reservoirs, and Physa cubensis
in 10 reservoirs, ?In all the reservoirs witch contained Blomphalaria
Blabrata, at least two and usually three of these other species oF sails
were present.

?A large ampullarid snail, probably a species:

found in Lake Carite, Cidra Lake and Lake Carraizo, These reservoirs also contained large masses of floating water hyacinth and showed no 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 impoundments - 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 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 was 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

Teas that has barely detectable phosphates and about 0.2 mg/liter nitrates,

[one would support those reports which suggest that the water heath

coverage is evident in removing nutrients from the waters Cidra Lake has

about twice as much chloride as any of the other lakes

NANTES, ge 8 indicator of contamination. Samples taken from lakes

Senay in the year had very low iron content, while samples taken from sube lakes during the winter had much more iron. This may reflect convection previously stratified lakes, Time studies will be necessary to verify this. At this time there is no obvious correlation between sea level and chemistry. The snow prediction models are in operation. Sensitive to the U.P.R., computer. A mobile laboratory and boats have been purchased and will be outfitted with basic equipment in time to bear. One boat will be used, 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 vegetation will be completed, The data on erosion, fire, pests, She Soo, Lake Teutewed and other reservoirs selected for intensive study, Laboratory will be taken for one week to each reservoir, the first of 5 quarterly surveys will be completed,

17, Expected Results ~ FY-1977

A complete annual cycle of 4 intensive Six reservoirs will be completed,

Will be developed for each reservoir

for the next year (FY-1978).

18, Expected Results ~ FY-1978

A second annual cycle of intensive surveys on the six

reservoirs will be completed. The observed snail populations will be

set against the previous computer predictions in order to verify the

reliability of the model. Appropriate adjustments will be made to

the model to integrate it for predictions in any proposed reservoir. Methods

and procedures for determining snail populations in existing reservoirs will be

developed and presented to the Power Authority for preliminary review

---Page Break---

Health Impact of Hydroelectric Power 189 No. 82

Reservoirs in Tropics

Description 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 & Communicatton - 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. pescription of Capital Equipnent by Fiscal Ys

Pumps, flow measuring \$7,000 \$ = \$5,000 \$5,000

devices and plumbing

for studies on water

Level fluctuations

---Page Break---

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 eauonoea] 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 l] ?2essy yaaeasoy

= ~ 00° ssu/sz/6 paaaeas pot UefeuR *h wsaEH IT ?20ssy 253;3U9198

~ ~ tee"? ?susst/eu

oaettegeo eyazeH 1 aaays0ssy ?eam

secior seztor art's zuytoz uote wos lunoag ?y puowiiey 1 3673u9}>5 JOpUAS

00*0TS dootor ¢ = ?= \$ -MOTREAEE UF x99 YOY ?aos ?ulgor ?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 yalEOH

---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; 2nvironmental &

Budget Activity Now: P=

Date Prepared:

+ Method of Reporting: Annual Pros

Working Location; Rio Piedras,

Person in Charge: Dr. Richard ϕ

Project Term: continuing

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 inpack 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 t» assess land monitor the environmental inpack of man's activities, (2) developing methods to estimate and predict the enviromental re=avonse to proposed and on-going 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 objective of the National Environmental Research Park (NERP)

Technical Progress FY-1976

Now Project

Actual Results in FY=1976:

Expected Results in FY=1977

During this year preliminary characterization of the site will be completed including the preparation of soil and vegetation maps, compilation of a bibliography of research conducted in the area 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

1%.

---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

?oaesae

---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

ak Ridge Operations 189 No. 65.

Rev. §/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, fverto Rico

Person in Charge: J. G. Gonedlez

8. Woject Term: Through FY-1977

9. Man Years: FY-1976

2. Setentitie 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 5,490 -

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.

%

Dublications and Research Progress

Reports ant Presentations, FY-1976

Durposo, Need and Scope

Objectives of the Bikini Project are

(2) To describe the distribution patterns of plutonium and americium in the marine waters, sediments and organisms of Bikini

Atolls

(2) To determine the influence of physical, chemical and biological parameters upon the movement of the fission products 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. Pu238, ^{239,260} and Am241 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 factors 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 were started as a cooperative program between the Laboratory of Radiation 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

---Page Break---

Bikini project 189 No. 65

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 analysed for plutonium content and gamma counting carried out. The 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 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

be

Bepected Resules in FY 1977

Plankton Samples

The forty-five plankton samples collecced in 1974 will be analyzed for the threc transuranium radionuclides. The results WIIT be relates! to thy curcent patteras in Dikini Lagoon, the patterns of the sane rarionuelides observed in the other series 95 plankton collected iy 1972, to the water sanples collected in 1974, and to the distriiution? patterns of the radionuclides observed in the hotton sediments

TL. Sediment core samples

Analyses of radionuclide content in the remining sediment.

core samples collected during the fail of 1972 ia the Bravo,

?Toua and Zont Craters will be completed,

At present four alpha detectors are being uted in our work. This

Limits the number of samples which may be analyzed because of

the Long counting time required. During 1977 we plan to buy two additional detectors to replace the damaged ones.

Repeated Results in 1974

Project terminates at the end of FY-1977.

Description and Explanation of Other Services

Estimated 1977-1978

Power

Shop Charges:

Reproduction charges

Transport and Comm.

Equipment Maintenance

Tuition

Computer

Annual Leave

Telephone

Miscellaneous

Electron. chat

Rental of Equipment

Consultant Fees

Reactor Charges

\$1,000 \$6,000

bee

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't

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 Ridye Operations 109 No. 80_

Bove 5/14/76

lth Inpect of

Project Title: Eptdemtological Models for Predicting Ms

Ehergy Related Facilities

2, Security Classification Unelassified

3. udget Activity Now: Rt 01 0

4. Date Prepared: apett 1976

5. Muthod of Reporting: FRNC Annual Report

Working Location: Rfo Pedras, Puerto Rico

forson in Charge: Willfan R, Jobin, Se. D.

Project Term: Terminates FY-77

% Fy-1976 Fy-197Q 178

a. Scientific 1300.75 1.00 °

b. Other Direct oe : :

Total 2.25 0.75 1.00 °

10, Operating Costs:

4. Direct salaries plus

Frinye Benotits

from Appendix A) \$28,400 \$ 12,850 § 20,500 0

D. Overhuad Costs (55 of a.) 21,900 9,600 1,500

©. Travel 1,300 a a e

dl. Materials and Supplies 6,000 250 5,000 ~

fe. Other Services

(itemized in item 19) 38,000

Total \$95,000

IL. Dquipment Obligations:

---Page Break---

---Page Break---

Epidentological Model 189 No. _80

13, Repovts and Presentations, FY 1976

None

14, Purpose, Need and Seope

With 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
powerplants 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 modelled 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 designs, 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 modelling program, in accordance with the limitation on funds.

A, Simulation Models for Schistosomiasis around reservoirs

The logic and Fortran IV programs have been obtained for

---Page Break---

Epidemiological Models? 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 Taped 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 data tables for comparison with the previous skin tests of 1966 and 1969,

1T prevalence of bilharri

To carry out the testint program in the schools, arranrenents were nade with the Department of Public Instruction for statistical information and coordination with individual teachers. randomised 25% sample of Sth grade classrooms vas selected from the present achool system and scheduled for testing in Apri! and av, Arrangeswnts were cooplece with the Depactment of Health for eix. nuzses to do the testing sith asstotance fron other regional personnel, All natertals inelwding antigen and disposable syringes have been obcatned,

©, Sumary of Available Epidentological Data for Puerto Rico

Avatlable epidemiological data has been surmartzed for 5 saall communities in Puerto Rico whore schistosomiasis transmission hae been Very intense in the past. Data and naps are available on hunan populations, fon infection rates and on snail populations. Detailed information on all aspects of transmission ts available for thee ef then, ?In addition the entire island has been divided into 12 cones and baste inforeation on

sanitation, human population, and schistosomiasis prevalence has been summarized in tabular form,

2, Epidemiological Data for African and Asian Reservoirs

During the year, site visits were made to Volta Reservoir in Ghana and Três Marias, Furnas 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 Zaire, Kaazou 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 set.

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 Afram arm of the lake where an epidemic of Schistosoma

---Page Break---

Epidemiological Yodet

occurred soon after filling of the reservoir,
was analysed on dispersion of schistosome aiti
of snail populations, and a comparison was made

189 wo. 60

Field and laboratory data
of 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 1Y-1978

Dependent on funding

19, Description and Explanation of Other Service

Bictomy FY-1977 Fre1978

Terminates

?

Powe

Shop Charges

Reproduction Charges

?Transportation & Communication

Equipment Maintenance

Tuttion

Computer

Annual Leave

Vehicles

Miscellaneous

Electronic Charges

Rental of Equipment

Consultant Fees

Reactor Charges

1,000

250

Total 8 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

Fev \$/14/76

1, Project Title: Effects of rose Fuel Pollutants on Human Health and

Biota fn the Troptes

2. Security Classification Unclassified

3. Budget Activity Now: RE 01 01

4. Date Prepared: Apett 1976

5. Muthod of Reporting: anmiat Report

©, Working Location: fo Piedras, Berto Rico

7. Porson in Charge: william R. Jobin, Se. D

8, Wroject Torm Terminates FY-77

9. Man Years:

a. Sctontifie

vo.

a.

b. Other Direct

Total

Operating Costs:

4. Direct salaries plus

Fringe Benefits

(from Appendix A) \$39,400 \$ 6,600 \$20,200 o

b. Overhead Costs (56% of a.) 29,600 5,000 11,300 -

©. Travel 1,000 500 -

Materials and Supplies 3,000 3,300 -

Other Services

(temized 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

?sity of Pucrto Rico ~ Contract No. E~(40=1)~1833,

Budgee FY=1978

Uni

Oak Ridge Operations 189 No. 71

1, Project Title: Marine Research Ship Operation Rev. 5/14/76

2, Security Classification: Unclassified

Budget Activity No.: RF 03 04

Date Prepared: April 1976

5. Method of Reporting: FRNC Annual Report

Working Location: Mayaguez, Puerto Rico

Person in Charge: J. G. González

Project Term: Continuing effort

Man: 1976 Y=

a. Officers 1.00 0.08 - -

b. Crew and support 609 oe

?Tora 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 - - :

fe. Drydocking 25,000 : - -

£. Other Services

(itemized in Item 19) 40,700

+ Boat Rental

Total 57,000

Other Credits 321,000

TOTAL 785,000

11, Equipment Allocation:

\$11,200 - - -

---Page Break---

Marine Research Ship Operation 189 No. 72

2.

a.

Me

1.

16

7

18.

ublications and Research Progress

None

Reports and Presentations, FY 1976:

The research vessel, R. F. PALIMBO, was built for the USERDA in San Diego, California in 1970-71 and was brought to Post to 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 PALIMHO 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

Bepected Results in F¥-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 proneane,

The Division estimates a need of approximate 120 days per year at a leasing rate of \$250-350/day.

?The possibility of purchasing @ research vessel from the PRIRA 4s being explored since it appears that the cost of operat ine 2 45") which would be adequate tor the researc

needs of the Division would be less than those incurred in rental or Teasing.

Expected Results in FY-1978:

Not applicable

---Page Break---

Marine Rescarch Ship operation

19,

20.

Deseription and explanation 0? oth

Pover

Shop charges

Reproduction Charges

?Transportation and Commsinicat to 90

Equipment aineenance -

Tuition :

Compuer :

Annual Leave 1,000

Vohie les

Miscellaneous 5,000

Electronic Charges 1000

Rental of Equipment -

Consultant Fees 7

Reactor Charges, :

General Expenses (fuel) 29,500

340,700

Description of capital tquigment by Fiscal Yoar

None

189 No.

6,000

n

---Page Break---

aviot

?ty sanzeuag aura

jeaqns

AranoH oot

wor

oot

sano ?oot

Ay a00% 200%

Atanou ?woot

?wor

00s osu's 00

- oct*9 ?wor

005 '« ?toot

sovte oor

ece'ts ooters ?00 uyerdeg aos

Ay z0uy5u2

bust-xa Suse Sy SORT ?ae Nora S08

TZ ?on oot

---Page Break---