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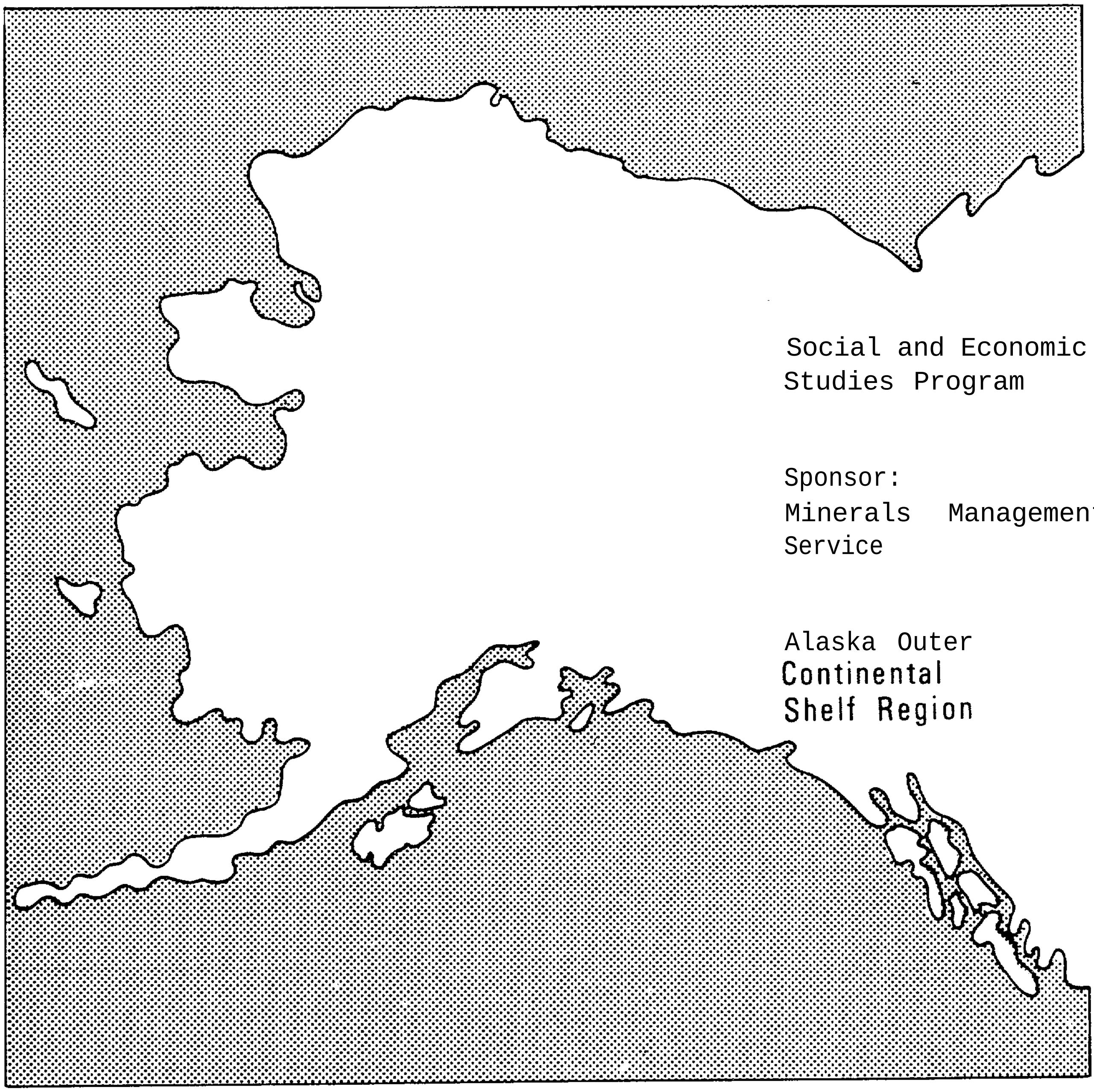

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Alaska Outer
Continental
Shelf Region

# Proceedings of a Workshop:

# Review of Outer Continental Shelf Economic and Demographic Impact Modeling for Rural Alaska.

SPECIAL REPORT NO. 6

OCS STUDY
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# PROCEEDINGS OF A WORKSHOP:

# REVIEW OF OUTER CONTINENTAL SHELF ECONOMIC AND DEMOGRAPHIC IMPACT MODELING FOR RURAL ALASKA

Prepared for
Minerals Management Service
Alaska Outer Continental Shelf Region
Leasing and Environment Office
Social and Economic Studies Program

by

Lawrence Johnson & Associates, Inc.

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## NOTICE



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REVIEW OF OUTER CONTINENTAL SHELF ECONOMIC
AND DEMOGRAPHIC IMPACT MODELING
FOR RURAL ALASKA

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

ABSTRACT

This report represents the proceedings of a workshop held in Anchorage to evaluate the modeling process by which the Minerals Management Service- Alaska Region assesses the social effects of OCS development. The purpose of the workshop was to help the participants gain a better understanding of how the modeling process works and to evaluate it in terms of improving its performance. MMS social scientists and outside modeling experts discussed each stage of the modeling process, identified some of its strengths and weaknesses, and came to some conclusions as to how the process might be improved.

# INTRODUCTION

On February 21 and 22, 1985 the Alaska Region of the Minerals Management Service (MMS) conducted a small workshop on the modeling process used to determine the social effects of OCS development in rural Alaska. Social scientists from the MMS Alaska Region Leasing and Environment Office and from the" Institute of Social and Economic Research (ISER) met together with outside experts on modeling and the Alaska economy to discuss their understanding of the modeling process and its strengths and weaknesses. This exchange was intended to accomplish two objectives:

- to help all of the participants in the modeling process and the users of its output better understand how the process works; and
- to evaluate the modeling process and identify ways in which it could be improved.

During the two-day work session, the participants were shown that the assessment of social effects which appears in the Environmental Impact Statement (EIS) for each OCS lease sale is an outcome of a comprehensive modeling process. Participants articulated the goals of the process and discussed whether the goals' were being accomplished. Each stage in the process was explained in terms of how it related to the whole, problems were discussed, and specific improvements to the modeling process were recommended.

Two papers published for the Social and Economic Studies Program (SESP) provided the impetus for this workshop: 1) "Sensitivity of RAM Model Projections to Key Assumptions" by Gunnar Knapp and Kathy MarkAnthony, and 2) "Challenges to Socioeconomic Impact Modeling: Lessons from the Alaska OCS program" by Larry Leistritz, et al. Kevin Banks of MMS and Gunnar Knapp of ISER were responsible for preparing this report. Cynthia Prather of Lawrence Johnson & Associates, Inc. and Thomas Newbury, the MMS Contracting Officer's Technical Representative, assisted in organizing the workshop and in preparing this report of the proceedings.

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# I. THE MODELING PROCESS

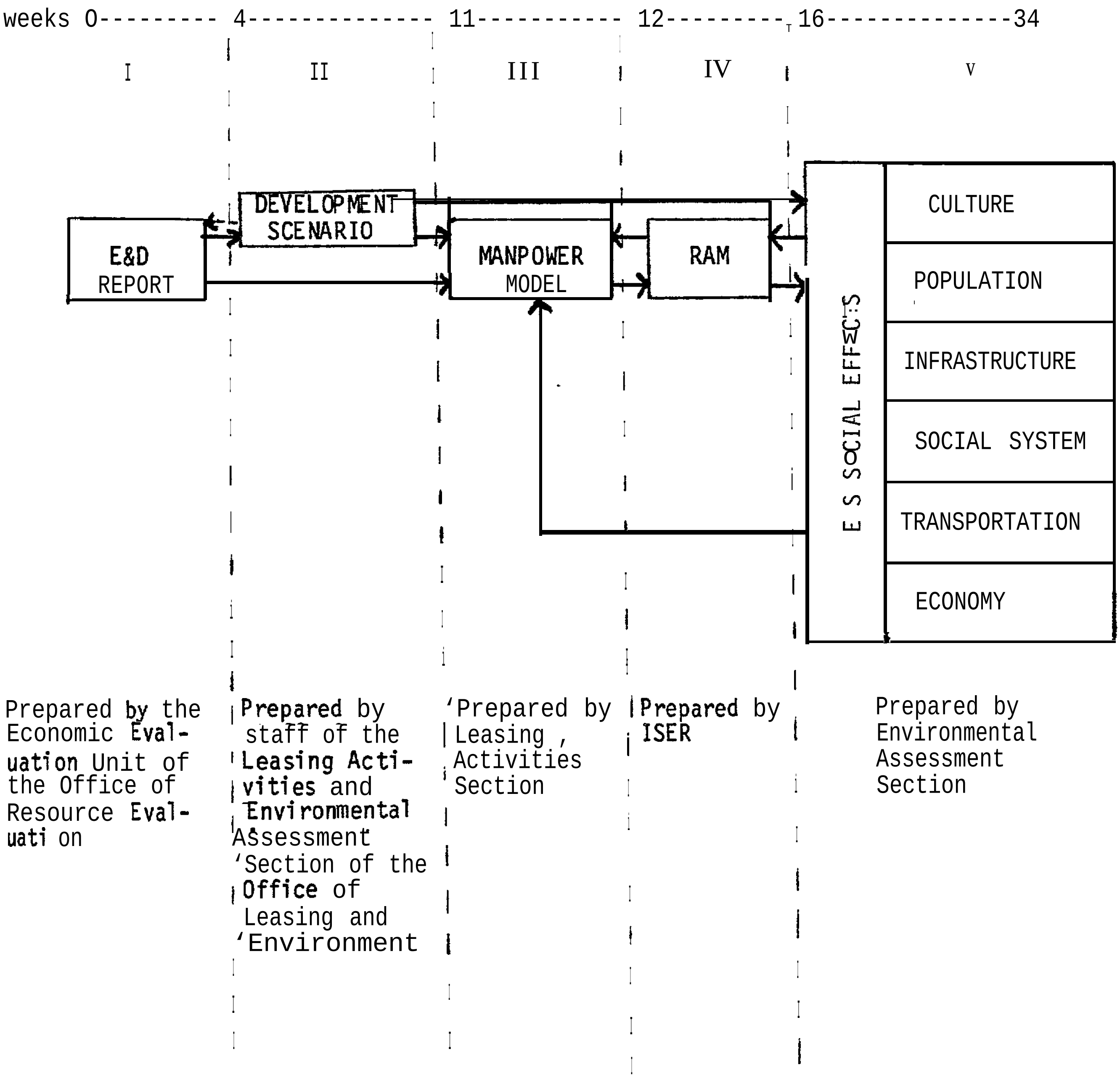
Essential to anyone's understanding of the way MMS analyzes the social effects of OCS development in Alaska is an appreciation that the analysis involves a series of modeling tasks. The assessment of social effects which appears in the EIS is the outcome of a process which involves five different modeling stages, four of which take place within the MMS (in three separate divisions) and one of which is undertaken by experts outside of and under contract to MMS. This process is illustrated in Figure 1. Although social effects may occur as the consequence of strictly environmental effects (the results of oil spills, noise, etc. on some important commercial or subsistence resources), the modeling process used by MMS concentrates strictly on the analysis of these effects associated with changes in local population and employment, and occasionally, in local revenues and expenditures. The five components of the modeling process are:

- o The Exploration and Development (E&D) Report;
- o The "Development Scenario;
- o The Manpower Model;
- o The Rural Alaska Model (RAM); and
- o The Environmental Impact Statement.

The process is initiated when a lease sale on the Alaskan OCS is scheduled. The Economic Analysis Unit of the Office of Resource Evaluation first prepares an Exploration and Development (E&D) Report in which are projected the number of exploration, delineation, and production wells; the number of exploration rigs and production platforms; the miles (or kilometers) of pipeline; the timing of development; and the annual level of oil and gas production that is likely to result from the scheduled lease sale. Appendix B1 is a sample of a recent E&D report prepared for

Figure 1

The Modeling Process



Lease Sale No. 89, the St. George Basin. Each of the components appearing in Appendix B1 are parts of the modeling process as applied to this particular sale.

The E&D report is based on several assumptions about the geological characteristics of the area to be leased and some consideration of the economics of oil and gas development in the area. The most important assumption, of course, is that the resource actually would be developed. Thus, the modelers and analysts in each subsequent step base their entire analysis on an assumption of considerable uncertainty. As will be shown, understanding the uncertainty associated with this initial step is essential to an evaluation of the process.

The second stage of the modeling process is the preparation of the development scenario. This is a narrative description, based on the E&D report, of the most important features of an offshore development. It provides greater detail than the E&D report and also identifies the locations of onshore marine and air activity support bases, oil terminals, liquid , natural gas (LNG) processing facilities, transportation routes, etc. This document is prepared by MMS staff in the environmental assessment section of the Office of Leasing and Environment (usually the same staff that subsequently prepares the EIS).An example of a scenario appears in Appendix B2. It generally appears as Section IV-A in the EIS.

The development scenario provides the basis for discussion of any physical, biological, or social effects in the EIS. For the social scientists, it is pertinent in two ways. It provides information that enables assessment of the effects of OCS development on subsistence and its related social systems, on commercial fishing, and on transportation systems. The scenario also provides the basis for the analysis of the more indirect effects of OCS development associated with changes in the local economy, population, and employment.

The scenario developed for the EIS is reviewed by personnel both within MMS and among oil firms currently operating in Arctic offshore regions. Sometimes controversies develop in these reviews. As a result of these reviews, scenarios are sometimes modified, usually by changing the assumed location for support bases or terminals or by reassessing assumed transportation links. This review, however, rarely leads to any changes in the E&D report. This lack of effective feedback to the E&D report often results in inconsistencies between the E&D report and the development scenario. Often these inconsistencies arise in the assumptions made in the E&D report about the location of crude oil transportation facilities and the mode of crude oil transportation to market.

The third-step in the modeling process is the preparation of manpower assumptions using the manpower model. Developed by Jim Sullivan in MMS, this model calculates manpower requirements based on well-defined assumptions about the crew size, shift and rotation factors, and the duration of each phase of exploration and development. The input data for the manpower model are based on both the E&D report and the development scenario. Essentially the model develops assumptions about the demand for labor by the offshore oil industry during the exploration, development, and production periods, thus adding to the assumptions prepared at earlier stages.

Appendix B3 is an example of the output of a manpower model run for a hypothetical lease sale. It shows the seasonality of OCS employment, the employment demand by industry, and most importantly for our purposes here, the number of onsite and offsite jobs in the community, whether they are short term or long term jobs, and whether they are skilled or unskilled jobs. (See Tables 5, 6, and 7; Appendix B3. ) The manpower model *also* produces several outputs not directly utilized in this modeling process but which add to the flexibility of the system. For example, the manpower model forecasts the number of workers by place of residence which may be used in an MMS-generated forecast of statewide effects. As will be explained below, the next step in the modeling process also generates labor market forecasts by place of residence but these are utilized for local employment and population projections.

There are several characteristics of the manpower model which deserve attention. The model is straight-forward and internally consistent, and in its configuration, it is a logical representation of the exploration, development, and production phases of an offshore oil find. Since it is a model of the manpower component of a special engineering technology, it lends itself well to input and review by industry to refine the assumptions about crew sizes, shift factors, and rotation factors. Its evolution has been closely linked with the development of the RAM model, the next stage of the modeling process, and therefore most of its outputs are specifically tailored to the requirements of the RAM model. These well-defined linkages between the models should exist at every stage in the modeling process.

The manpower model also is linked to the scenario in as much as the staffer who runs the manpower model also participates in the preparation of the scenario. A potential inconsistency can arise, however, in that the requirements for transportation facilities and equipment by the OCS development are not analyzed in the scenario.

These requirements are usually analyzed as impacts in the relevant sections of the EIS. In so far as the author of the manpower model may not have access to this analysis until after the EIS is prepared, manpower requirements for the transportation sector may be incorrect.

The fourth stage of the modeling process is the Rural Alaska Model (RAM), 'which was developed by the Institute of Social and Economic Research (ISER). ISER uses RAM to prepare projections of the impacts of OCS petroleum development on population and employment in rural Alaskan communities. The RAM model is actually not one fixed model, but rather a modeling structure that is modified for each community to take into account the different economic and demographic characteristics in rural Alaska. Sample RAM outputs appear in Appendix B4.

The RAM model projects total population and employment for a community. In order to project impacts of OCS development, separate projections are calculated for a "base case" which assumes no OCS development, and an "impact case" which includes an assumed OCS development. The projected impacts of OCS developments are the differences between the projected impact and base cases. Appendix B4 provides examples for RAM model projections for Unalaska, as well as assumptions which were used for these projections.

The RAM model structure is most easily viewed as five separate submodels:

- The Population Submodel;
- The Labor Demand Submodel;
- The Labor SUpply Submodel;
- The Labor Adjustment Submodel; and
- The Migration Submodel.

The Population Submodel calculates population for separate age-sex-race cohorts based on assumed survival rates, fertility rates, and non-economic or exogenous migration rates. The Labor Demand Submodel calculates demand for skilled and unskilled labor based on assumed labor requirements in "basic" industries such as mining, fishing, and OCS development, as we'll as induced labor demand in secondary industries such as government and services, which is calculated using multipliers. The Labor Supply Submodel calculates local skilled and unskilled labor supply based on assumed labor force participation rates and training rates for skilled labor. The Labor Adjustment Submodel calculates how many jobs are filled by local labor as opposed to non-local labor. Finally, the Migration Submodel calculates migration resulting from the departure of local workers unable to find jobs or the arrival of non-local workers to take jobs. The RAM model structure is documented in detail in several recent Social and Economic Studies Program' (SESP) Technical Reports. Under its current contract with MMS, ISER is currently preparing a detailed review of the RAM model structure, which will incorporate the suggestions of this conference.

The RAM model incorporates not only numerous assumptions about the community's economic and demographic structure, but also the assumptions developed for the E&D report, the development scenario, and the manpower model. These assumptions developed by the three earlier stages of the modeling process are critical to the RAM model's projected impacts of OCS development. It is also important to note that these assumptions are needed for <u>both</u> the base case and the impact case, since often some degree of oil development is assumed for the base case as well as the impact case.

Those sections of the EIS which are concerned with the description and assessment of social effects comprise the fifth and last step in the modeling process. Appendix B5 presents several pages from the Sale 89 St. George Basin EIS which incorporates RAM model projections and analyses based on those projections. MMS social scientists use the forecasts provided by the RAM model to project the effect of OCS development on local social services, schools, and the local infrastructure. In some instances, it is important to know what the composition of the population will be with the coming of offshore development in order to predict the level and significance of whatever social and political changes which may occur caused by increased interaction between long term residents and newcomers.

As was mentioned above, these latter kinds of social effects are not the same as those which occur as a consequence of environmental changes associated with OCS activities. They are, however, related. Changes in commercial or subsistence harvests due to oil spills or other agents have an indirect effect on employment and populations in the communities which are modeled, but these effects are not incorporated in the model in its present form.

The EIS authors have the responsibility of synthesizing the effects on population and employment forecasted by the RAM model with the analyses contained in other SESP reports and the authors' own experience with the community to capture all of the effects of OCS development.

Over the last two years, EIS authors and the staff at ISER who prepare RAM model projections have worked very closely together on the preparation of model outputs. Some of the most recent changes in the RAM model structure have been the result of this ongoing consultation. The current complexity of the RAM model outputs is directly attributable to the requirements set out by the EIS authors.

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## II. GOALS OF THE MODELING PROCESS

Early in the workshop, participants addressed the goals of the modeling process. Consensus on the goals and purpose is critical to the evaluation of the modeling process on any of its component modeling tasks.

Participants agreed that the purpose of the modeling process is to prepare impact projections for particular OCS lease sales which meet the standards required for an EIS. An indirect role is to direct the agency's studies agenda by illustrating weaknesses or gaps in the existing knowledge base.

One related question that was raised involved the role of the EIS: whether the EIS is intended to function as a planning document or an information document. It was explained that, although local and state agencies often look to an EIS as a source of information upon which planning decisions may be based, the EIS is not written for that purpose. The EIS needs to be as accurate as necessary to meet the mandate of the National Environmental Policy Act (NEPA). It is intended only to assess the effects of MMS decisionmaking regarding offshore lease sales.

Other concerns involved the quality of the output required by the EIS. Given the cost, time, and labor expended in running the model and the relatively small amount of data from the model that is incorporated into the EIS, is the model currently generating too much detail? Also, since oil discovery is uncertain, and if discovered, the actual magnitude of the resource discovery is not known, the EIS in fact represents a discussion of the impacts of one or more hypothetical situations. The uncertainty of this most basic assumption -- the magnitude of the discovery -- leads to uncertainty throughout the modeling process, and limits the level of detail which it makes sense to try to generate from the modeling process.

To provide the information required for the EIS, the group agreed that the modeling process should meet the following basic criteria:

- The modeling process should be sufficiently detailed to provide evaluation of the social and economic impacts of OCS lease sales, while avoiding unwarranted complexity or spurious accuracy.
- The modeling process should be defensible, both legally and scientifically. It should use accepted projection methods which represent the state of the art in impact modeling.
- The modeling process should be well-documented and replicable. All assumptions should be clearly stated so that the process by which impact projections were reached can be repeated for verification, if necessary.
- The modeling process should be understandable by persons interested in the projections. However, given the complexity of economic and demographic impacts, there is at least some trade-off between simplicity and defensibility.
- The modeling process should use sensitivity analysis, where practical, to delineate he range of uncertainty associated with projections.
- The modeling Process should have clear and documented assumptions.

A final goal of the modeling process which was mentioned but not extensively discussed was that it should be cost-effective.

Participants generally agreed that the current modeling process meets these goals in a reasonable fashion. While changes and improvements can and should be made, there is no need to abandon or drastically modify the current modeling process. In particular, the authors of the final stage of the process-- the environmental assessments-- felt that they have been receiving the kind of information that they needed to prepare impact descriptions, and that they had reasonable confidence in the modeling process.

## III. THE MODELING PROCESS: DISCUSSION AND RECOMMENDATIONS

During the workshop, there was extensive discussion of each stage of the modeling process. This section reviews the major recommendations which emerged and the discussion leading to those recommendations.

### Exploration and Development Reports and Scenarios

- E&D reports and scenarios should be prepared according to a standard format, and a system for numbering and identifying different scenarios should be established.

In the past, scenarios have often lacked a definite format. To date, there have been no guidelines to indicate what should be included in the scenario or how it should be presented. Sometimes scenarios have not included critical assumptions, such as transportation assumptions. These exclusions have often resulted in ad hoc, last minute additions that are not thoroughly reviewed. Because scenarios are frequently edited or changed to incorporate suggestions, different actors in the modeling process have found themselves using different versions of the scenarios. Communication has sometimes been weak between the persons who develop the scenario and the users of the scenario.

One step in overcoming these problems would be to develop a standard format to specify what information should be included in each scenario. Each version should have a title, a number, and a date, so that all persons reviewing or using the scenario would be aware of the version being used and could be assured that it is the. proper version.

- All scenarios should include not only the oil and gas development assumptions for the lease sale question (the impact case), but also the 011 and gas development assumptions if the lease sale does not occur (the base case).

Both sets of **assumptions** are crucial to analyzing the impacts associated with the sale. In early MMS impact assessments, if the lease sale did not occur, no oil development would take place. However, many lease sales are now the second or third scheduled sales in an area, and oil development might well occur in these areas even without the particular sale which is being analyzed. Therefore, it is no longer sufficient to have a scenario **only** for what would happen if the sale occurs. To analyze impacts, one must also have a scenario for what would happen if the sale does not occur.

- For some sales, more than one scenario should be developed.

Often the actual chance that development will occur is only 15 percent or less. Thus, it may be appropriate in some cases to analyze not only an oil development scenario, but also an exploration only scenario. Where the range of possible oil development is wide, it may also be appropriate to analyze two or more development cases, such as a low and a high case. Even if these analyses are not included in the EIS itself, they could provide a better indication of the range of possible impacts.

- Further opportunities for industry review and input of he report and the scenario should be **explored.**

In particular, more information could be obtained from the oil industry on the nature of OCS support bases, such as whether or not enclave development is likely and what kinds of local hire are likely.

## The Manpower Model

As was discussed above, the manpower model is systematically organized, is well-documented, and lends itself well to input and review by industry. The links between the manpower model and the scenario as well as the RAM model are clearly defined. Thus, only a few minor recommendations were developed for this stage of the modeling process.

- o The manpower model's projections of local hire and enclaving should conform more closely to hose provided by the RAM model.

At present, the two models project local hire and enclaving in different ways. Although the practice has been to use the RAM model's projections, the difference is a possible source of confusion. While there is no problem at present, one or both models might be modified in the future to reduce this potential confusion. Some participants felt that the manpower model's procedures for predicting how many workers would be hired from the community or would live in the community were based on estimated rather than real data, thereby reducing the validity of the manpower model's projections. Others responded that the more elaborate procedure incorporated in the RAM model is also based on estimates, but that the estimates simply occur at a different level.

- o Opportunities to account for differences between rural areas in the development of manpower model coefficients should be explored.

Not all areas of the state are the same, and offshore jobs do not affect all towns within a lease sale area in the same manner. Opportunities to account for these differences without compromising the simplicity or practicality of the model should be explored.

o Manpower model assumptions should be updated where possible by Incorporating new data.

One participant suggested that new data are available on the percentage of workers who commute into Alaska. (This information is not specifically incorporated into the RAM model projections, but is occasionally used in analyzing statewide impacts of OCS development.)'"

## The RAM Model

The conference's discussion of the RAM model was wide-ranging. It resulted in a number of general and specific conclusions relating to the RAM model structure and its relationship to the overall OCS modeling process.

o The basic scope of the RAM model is appropriate.

The model should continue to focus on projecting employment and population impacts, and should not be expanded to attempt to project such impacts as changes in subsistence activity or household size. The modeler's expertise does not lie in these areas, and these important effects are better dealt with separately.

The model structure could be expanded, however, to incorporate impacts resulting from additional property tax revenues and other revenues which local governments might receive as a result of OCS developments.

o Further basic research on certain aspects of rural laskan economics could contribute significantly to understanding the possible Impacts of OCS development in rural Alaska, as well as Incorporation of these effects in the RAM model. These areas include:

The nature of economic structural change as communities grow in size and as OCS facilities are introduced.

- The determinants of migration into and out of rural Alaskan communities, both by natives and non-natives.
- The factors affecting the extent to which local residents would be employed by OCS projects, including "labor force participation" of native Alaskans.

o <u>Lack of basic data is a major problem in modeling OCS impacts on rural Alaska. Possibly the most significant Improvement to the modeling process could result from the collection of better data on population and employment in rural communities.</u>*

There are several ways in which better data would be obtained, including:

- Better coordination with other SESP contractors doing detailed field studies, to ensure that these contractors collect the specific information needed for assessment of OCS impacts.
- Coordination (and possibly contracting) with the Alaska Department of Labor to obtain community-specific employment data which is currently collected but not published. The MMS is *now* negotiating with the agency for such data.
- Official endorsement by the MMS of continuation and more timely publication by the Alaska Department of Labor of the employment data in the <u>Statistical Quarterly</u>.
- Development and publication of historical data series, where possible, for variables projected by the RAM model, to permit validation of the reasonableness of RAM model projections.

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*ISER has conducted research on these areas in the past, and is carrying out additional research on structural change and labor force participation under *its* current contract with MMS. The results of this research will be incorporated in the RAM model review process.

- Better communication with oil industry representatives to obtain more information about the nature of OCS development, such as the likely extent of local and worker "enclaving."

o <u>The definition of different concepts of employment and population is a major problem in projecting employment and population and in explaining the results of projections. Current definitions should be reviewed and possibly modified in order to reduce the confusion which they currently cause and to improve the validity and usefulness of the modeling process and projections.</u>

Different concepts of employment (and population) which have caused confusion in the past include:

- Resident employment
- Non-resident employment
- Seasonal employment
- Full-time equivalent employment
- Peak employment
- Enclave employment
- Part-time employment

These terms mean different things to different people. For example, ISER has used the term "resident population" to include all persons who interact fully with the local economy on a year-round basis. However, others interpret "resident population" to mean those persons living in a community prior to a certain date (e.g., prior to development of OCS), as opposed to newcomers who may be living in the community. It is therefore important to determine which concepts of employment are most useful, and to define these concepts clearly. This may necessitate some revisions in the RAM model.

o <u>The RAM model should be reviewed to ensure that its labor market submodels take appropriate account of the wide diversity in the kinds of jobs which exist in rural Alaska and the kinds of workers who fill these jobs. The model should seek the most appropriate balance between theoretical validity and simplicity in modeling labor markets.</u>

For example, to be realistic, the model should ideally take account of the high degree of seasonality in certain kinds of employment: the fact that certain kinds of jobs (including many oil industry jobs) are available only to non-local workers; the fact that many residents will not willingly take year-round employment even if it is available; the fact that many workers live in separate "enclaves" isolated from the community; and the fact that many workers do not have the skills to take certain kinds of jobs which they might like. However, to "correctly" model this complicated labor market may be more difficult than is warranted, given the nature of available data and the uncertainty of other basic model assumptions. This may justify the use of a simpler model which merely incorporates best-guess assumptions about local labor shares in OCS employment-.

- <u>Given the degree of uncertainty associated with many model assumptions -- including the actual extent of OCS development -- the RAM model should remain relatively simple in structure</u>.

The model has evolved over time to a degree of complexity which approximates a reasonable balance between complexity and theoretical justification. Any further increase in model complexity should be undertaken only if it will definitely improve the usefulness of model outputs.

- <u>All RAM assumptions should be thoroughly documented and easy to understand</u>.

- <u>Sensitivity analysis should be used to delineate the degree of uncertainty associated with model projections.</u>

Recent RAM model projections have included the use of sensitivity *analysis.* This should continue and be expanded in the future.

- <u>MMS and ISER should explore opportunities for reprogramming the RAM model in Lotus 1-2-3 to permit better coordination and more flexibility in the use of the RAM model.</u>

The RAM model is presently programed in TROLL, a powerful computing language designed expressly for time-series simultaneous system modeling. TROLL is housed in the MIT computer and is accessed by telenet phone lines. Although TROLL is easily used by ISER personnel, it is inaccessible to MMS. As a result, even the smallest changes in model assumptions require additional programming by ISER, as well as typing and explanation of results to MMS.

MMS has a number of IBM personal computers with the powerful spread sheet program LOTUS 1-2-3. ISER has recently acquired personal computers and LOTUS 1-2-3 capacity. It may be possible to reprogram the RAM model in LOTUS 1-2-3. If this could be done, the RAM model could be an enormously more flexible tool, because ISER could provide MMS not only with printouts of model projections, but with an entire model which could subsequently be used for in-house analysis, sensitivity testing, and adjustment for changes in assumptions. ISER's expertise in rural economic modeling and in developing model assumptions would still be available to MMS, and ISER could devote a greater portion of its time in these areas rather than in “turning the crank” to produce model runs as assumptions change.

Portions of a model similar to RAM have already been developed and programmed in LOTUS 1-2-3. This program could be used to project OCS economic and demographic impacts in rural Alaska. The structure of this in-house model differs in some respects from that of RAM: in particular, the method of allocating jobs between local and imported labor is much more direct. Workshop participants felt that elements of both models had merit. Reprogramming of RAM in LOTUS 1-2-3 might provide an opportunity to incorporate the best aspects of each model.

There are some practical difficulties involved with reprogramming RAM *in* LOTUS 1-2-3 which would have to be overcome. In particular, the difficulty of programming simultaneous equations in LOTUS 1-2-3 is uncertain. In addition, LOTUS 1-2-3, while particularly well-adapted for printing model output, is less suitable than TROLL for documenting model equations. ISER will be exploring the difficulty of reprogramming RAM in its ongoing RAM model review.

## The Environmental Impact Statement

There was relatively little discussion at the workshop about the final stage of the modeling process-- the use of RAM model outputs by EIS authors. As discussed above, EIS authors felt that they had been receiving the kind of information that they needed to prepare impact descriptions, and that they had reasonable confidence in the modeling process. EIS authors did express a desire for some additional information from the modeling process. The kinds of information mentioned as desirable included:

- more detailed age breakdowns (for instance, five-year age groups), which could be used in predicting the demand for social services and schools; and

- more detailed breakdowns between native and non-native populations, and between newcomers and long-term residents.

While all workshop participants agreed that this kind of information would be desirable, some questioned whether additional detail was justified, given the inherent uncertainties in the modeling process, especially the uncertainty as to the magnitude and even the location of the actual oil development.

Some EIS authors also suggested that the annual detail in the projections was not really necessary after the first ten-year period. Other participants pointed out, however, that this additional detail could be provided at no extra cost, since the model structure is based on year-by-year projections. In fact, it would be more difficult to eliminate annual projections than to incorporate them in some cases. In addition, annual projections allow for a more detailed tracking of why changes occur than would be possible with five or ten-year projection intervals.

## IV. CONCLUSIONS

The workshop achieved its two broad goals of helping participants understand the current process used by MMS in modeling OCS economic and demographic impacts in rural Alaska, as well as providing recommendations for improving this process. In this section, the overall conclusions reached in the discussions during the workshop are reviewed.

### 1. Participants agreed that the current process is working.

The current modeling process is providing the basic information needed to prepare those sections of the Environmental Impact Statement which address economic and social impacts in rural Alaska. The EIS authors are reasonably satisfied with the information they are receiving from the modeling process. Although workshop participants provided numerous suggestions for improving the process, 'these recommendations tended to be specific, calling for generally minor changes or improvements rather than a whole-scale abandonment or drastic modification of the process.

### 2. There is significant uncertainty in fundamental assumptions underlying the development of impact projections. As a result, substantial uncertainty in impact projections is unavoidable.

Much of this uncertainty results from the fact that the location and extent of oil resources are unknown and must be assumed. This uncertainty, introduced at the very first stage of the analysis in the E&D report, is expanded at each subsequent stage as more assumptions are introduced. In many cases, uncertainty can be reduced by further research, by expanded review of assumptions, and by improved modeling. However, it cannot be completely eliminated.

3. Because of the uncertainty in fundamental assumptions, he modeling process should not attempt overly detailed proj ecti ens.

At each stage, theoretical rigor and complexity of the analysis must be balanced by the limits to accuracy in the development of assumptions.

4. Sensitivity testing and the examination of several different scenarios can help to delineate the extent of uncertainty in model projections.

While only a limited number of scenarios can be examined, participants agreed in many cases that the use of only one "development" scenario is not justified, even though only one scenario may be discussed in detail in the EIS.

5. Throughout the modeling process, assumptions as well as model structure shoul d be clearly documented and understandable.

Most importantly, scenarios should be complete and clearly identified, so that all stages of the modeling process use a consistent scenario.

6. The modeling process could be facilitated by improved coordination between different stages of the process.

One particularly significant opportunity for coordination involves the reprogramming of the RAM model in a computer 1 anguage which coul d be used by both ISER and MMS.

7. Further research on the process of economic change in rural laska, Incorporation of this research in the structure of the RAM model, and review of the RAM model structure could improve this stage of the modeling process.

Some parts of the RAM model should be simplified, in light of the limited information available on which to base assumptions. Other parts should be expanded to take better account of the complexities of rural economies and the ways in which these economies differ from developed urban economies. These changes will require a balance between the relative advantages and disadvantages of simplicity, theoretical rigor, and defensibility of assumptions in modeling rural Alaska.

8. Lack of basic data is a major problem in modeling OCS impacts on rural laska.

Possibly the most significant improvement to the modelling process could result from the collection of better data on population and employment in rural communities. In addition, MMS should encourage the timely publication of the Statistical Quarterly by the Alaska Department of Labor.

## V. BIBLIOGRAPHY

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# APPENDICES

APPENDIX A

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# Appendix E-1

# Exploration and Development Report

CW-ORE

UNITED STATES
DEPARTMENT OF THE INTERIOR

MINERALS MANAGEMENT SERVICE

Alaska OCS Region

OCT 23 4 13 PM '82

OCT 22 1982 Fred
Sale 89

Offshore Leasing
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Memorandum

To: Minerals Manager, Alaska Outer Continental Shelf Region

Through: Deputy Minerals Manager, Offshore Resource Evaluation
Supervisor, Tract Evaluation Section

From: Supervisor, Economic Evaluation Unit

Subject: Exploration and Development Report,
OCS Lease Sale 89, St. George.

The enclosed report was requested by Mr. Bob Rioux in his letter to you dated July 27, 1982. If the report meets with your approval, please forward it to Mr. Rioux.

Charles L. Wilson

Charles L. Wilson

Enclosure

OCT 22 1982

# Exploration and Development Report for Proposed OCS Sale No. 89 St. George Basin

Charles L. Wilson
Harry Akers, Jr.
Stephen D. Adams

September 24, 1982

Alaska OCS Region
Minerals Management Service
Anchorage, Alaska

## Introduction

The geographic area of interest for this proposed sale is assumed to be a long narrow strip of submerged land lying north of the Aleutian Islands. It is roughly 150 miles wide and 300 miles long. The sale area reaches as far east as the 165° west longtitude line and as far west as approximately 169° west longtitude. It is bound on the north by the 300 feet bathymetric contour line and on the south by the 650 feet bathymetric contour, approximately. It would also exclude any lands which may be leased in St. George Basin Outer Continental Shelf (OCS) Sale 70.

## Resource Cases

| | Conditional | Undiscovered | Recoverable | |
|---|---|---|---|---|
| | Low(1) | Medium(2) | High | Maximum |
| Oil (Bil. Bbls) | 0.14 | 0.53 | 1.04(3) | 4.15(5) |
| Gas (TCF) | 0.79 | 2.95 | 4.83(4) | 14.94(6) |

## Data Sources

(1) Low case is the "most likely" scenario from a memorandum from the Associate Director for Offshore Minerals to the Minerals Manager, Alaska Region, concerning this report, dated July 27, 1982. Since the amount of gas in the low case is below the economic threshold of approximately 3 TCF in one optimally placed field, the gas will be used on lease and not sold.

(2) Medium case is the conditional mean estimate in the same memorandum.

(3) High oil is 25 percent of unrisked mean resources, based on number of fields and oil field sizes, as listed in Table C-4 of the December 1981 National Petroleum Council Study entitled "U.S. Arctic Oil and Gas".

(4) High gas is based on the NPC study and its Table 1 risked mean gas/oil ratio .

(5) Maximum oil is 100 percent of unrisked mean resources, as listed in Table C-4 of the NPC study.

(6) Maximum gas is based on the NPC study, Tables 1 and C-3.

## Technologies

Exploration of the St. George Basin area can be accomplished using heavy-duty existing technology. Drilling of exploration wells may be done using semi-submersibles that are currently being used in the North Sea. Since this area may be covered with sea ice in the winter, ice-strengthed drill ships might also be used. The drill ships could be supported with ice-breaking supply boats. Since the water depth is greater than 300 feet and the area may be seasonally ice covered, jack-up type rigs will probably not be used.

Development and production could be accomplished using proven platform designs which are currently being used in the Cook Inlet and the North Sea. Subsea completions are unlikely due to the deep water depths, and their use is assumed to be nil.

## Estimated Well Depths

Average exploratory well depth: 14,000 feet

Average delineation and production well depths: 11,000 feet

## Facilities by Resource Case

| | Low | Medium | High | Maximum |
|---|---|---|---|---|
| Number of exploratory and delineation wells | 8 | 15 | 21 | 42 |
| Number of production wells | 7 | 42 | 77 | 284 |
| Number of service wells | 2 | 9 | 17 | 69 |
| Number of platforms | 1 | 3 | 5 | 10 |

## Transportation

A major problem in the development of transportation scenarios for the sale area is the uncertainty of significant reservoir or structure locations, as well as the actual sale boundaries. We thus offer some guidelines by which answers to the specific questions may be developed.

From the center of the sale area to either Dutch Harbour or Cold Bay is about 200 pipeline miles. When we use the term, Dutch Harbor, we are refering to Dutch Harbor, Unalaska, Makushin Bay, and similar locations west of Unimak Pass. When we use the term, Cold Bay, we are refering generically to several potential sites east of Unimak Pass, such as

Ikatan Bay and Morzhovoi Bay. On a pipeline cost basis, Dutch Harbor and Cold Bay are essentially equal.

Each oil well in its peak year should product about 1.3 - 1.5 million barrels on average. They will not all peak in the same year and the peak can be expected to cover several years. Each non-associated gas well will produce about 6.4 - 8.1 BCF in its peak year, and peaking will be spread out to assure a stable flow - which for gas may be twenty years.

The "Low" resource of oil (140 million barrels) must be located in one field or it will clearly be uneconomic. It could be developed with one 10" pipeline, at the largest, but this scenario is definitely marginal, at the very best.

The "Maximum" resource level could be developed with one 30" trunkline for oil and one 36" trunkline for gas, with both trunklines being routed to either the Dutch Harbor or Cold Bay areas. From the Dutch Harbor or Cold Bay areas the oil and gas would be moved by oil tankers and LNG tankers to market.

The other cases would range between these line sizes. Without knowing where the resources may be located, it is difficult to be very precise with logistical matters. Offshore oil and gas pipeline systems typically require booster stations every 80 to 100 miles, so at least one pipeline platform will be required to move the oil and gas to either Cold Bay or Dutch Harbor.

## Timetable of Development

Timetables of development for the sale area at each of the four resource levels are listed on the following pages.

## 1. SALE "89" LOW OIL AND GAS CASE

| CAL. YEAR | XPL & DEL WELLS ## | XPL & DEL WELLS RIGS | PLATS AND EQUIP (STARTS) | PROD & SV WELLS ## | PROD & SV WELLS RIGS | TRUNK P/L MILES | SHORE TERMS | PRODUCTION OIL MMBBL | PRODUCTION GAS BCF |
|---|---|---|---|---|---|---|---|---|---|
| 1984 | | | | | | | | 0 | 0 |
| 1985 | | | | | | | 0.1 | 0 | 0 |
| 1986 | 1 | 1 | | | | | | 0 | 0 |
| 1987 | 2 | 2 | | | | | | 0 | 0 |
| 1988 | 2 | 2 | | | | | | 0 | 0 |
| 1989 | 2 | 2 | | | | | | 0 | 0 |
| 1990 | 1 | 1 | 1 | | | 75 | 0.3 | 0 | 0 |
| 1991 | | | | 7 | 1 | 75 | 0.4 | 0 | 0 |
| 1992 | | | | 2 | 1 | 50 | 0.2 | 19 | 0 |
| 1993 | | | | | | | | 18 | 0 |
| 1994 | | | | | | | | 16 | 0 |
| 1995 | | | | | | | | 14 | 0 |
| 1996 | | | | | | | | 13 | 0 |
| 1997 | | | | | | | | 12 | 0 |
| 1998 | | | | | | | | 11 | 0 |
| 1999 | | | | | | | | 9 | 0 |
| 2000 | | | | | | | | 8 | 0 |
| 2001 | | | | | | | | 7 | 0 |
| 2002 | | | | | | | | 7 | 0 |
| 2003 | | | | | | | | 6 | 0 |
| ==== | 8 | 2 | 1 | 9 | 1 | 200 | 1.0 | 140 | 0 |

### ASSUMPTIONS

OIL: 1 PLATFORM, 7 PROD'N WELLS + 2 SERVICE WELLS
DRILLING RATE = 12 PROD'N WELLS PER YEAR PER PLATFORM

## 2. SALE "89" MEDIUM OIL AND GAS CASE

| CAL. YEAR | XPL & DEL WELLS ## | XPL & DEL WELLS RIGS | PLATS AND EQUIP (STARTS) | PROD & SV WELLS ## | PROD & SV WELLS RIGS | TRUNK P/L MILES | SHORE TERMS | PR O DUCT OIL MMBBL | |
|---|---|---|---|---|---|---|---|---|---|
| ==== | == | ==== | ======== | == | ==== | ===== | ===== | ===== | |
| 1984 | | | | | | | | | |
| 1985 | | | | | | | | 0 | |
| 1986 | 2 | 2 | | | | | 0.1 | 0 | |
| 1987 | 3 | 3 | | | | | | 0 | |
| 1988 | 3 | 3 | | | | | | o | |
| 1989 | 3 | 3 | | | | | | n | |
| 1990 | 3 | 3 | 1 | | | | | 0 | |
| 1991 | 1 | 1 | 1 | | | | 0.2 | 0 | |
| 1992 | | | 1 | | | 100 | 0.3 | 0 | |
| 1993 | | | | 12 | 1 | 100 | 0.2 | 0 | |
| 1994 | | | | 14 | 2 | 100 | 0.2 | [illegible] | |
| 1995 | | | | 18 | 2 | 100 | | 19 | |
| 1996 | | | | 10 | 1 | | | 22 | 1 |
| 1997 | | | | | | | | 40 | 1 |
| 1998 | | | | | | | | 42 | 1 |
| 1999 | | | | | | | | [illegible] | [illegible] |
| 2000 | | | | | | | | 42 | 1 |
| 2001 | | | | | | | | 40 | 1 |
| 2002 | | | | | | | | 38 | 1 |
| 2003 | | | | | | | | 34 | 1 |
| 2004 | | | | | | | | [illegible] | [illegible] |
| 2005 | | | | | | | | 27 | 1 |
| 2006 | | | | | | | | 24 | 14 |
| 2007 | | | | | | | | 21 | 14 |
| 2008 | | | | | | | | 19 | 14 |
| 2009 | | | | | | | | [illegible] | [illegible] |
| 2010 | | | | | | | | 15 | 14 |
| 2011 | | | | | | | | 13 | 14 |
| 2012 | | | | | | | | 11 | 14 |
| 2013 | | | | | | | | 10 | .4 |
| 2014 | | | | | | | | [illegible] | [illegible] |
| 2015 | | | | | | | | 8 | 13 |
| 2016 | | | | | | | | 7 | 10. |
| 2017 | | | | | | | | 0 | 6 |
| | | | | | | | | 0 | .4 |
| ==== | == | == | ====== = | == | == | ==== | ==== | === | == |
| | 15 | 3 | 3 | 54 | 2 | 400 | 1.0 | 530 | 2951 |

ASSUMPTIONS

GIL: 2 PLATFORMS, 27 PROD'N WELLS + 1 SERVICE WELL PER 3 PROD'N WELLS
DRILLIN G RATE = PROD'N WELLS PER YEAR PER PLATFORM

GAS: 1 PLATFORM, PROD'N WELLS
DRILLING RATE = 12 WELLS PER YEAR PER PLATFORM

## 3. SALE "89" HIGH OIL AND GAS CASE

| XPL & DEL WELLS ## | XPL & DEL WELLS RIGS | PLATS AND EQUIP (STARTS) | PROD & SV WELLS ## | PROD & SV WELLS RIGS | TRUNK P/L MILES | SHORE TERMS | PRODUCTION OIL MMBBL | PRODUCTION GAS BCF |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 0 | 0 |
| | | | | | | 0.1 | | 0 |
| 2 | 2 | | | | | | 0 | 0 |
| 3 | 3 | | | | | | 0 | 0 |
| 5 | 5 | | | | | | 0 | 0 |
| 5 | 5 | | | | | | 0 | 0 |
| 4 | 4 | 1 | | | | 0.2 | 0 | 0 |
| 1 | 1 | 1 | | | 100 | 0.3 | 0 | 0 |
| 1 | 1 | 2 | 12 | 1 | 100 | 0.2 | 0 | 0 |
| | | 0 | 18 | 2 | 100 | 0.2 | 0 | 0 |
| | | 1 | 25 | 2 | 100 | | 19 | 0 |
| | | | 18 | 2 | | | 28 | 115 |
| | | | 12 | 1 | | | 46 | 230 |
| | | | 12 | 1 | | | 55 | 239 |
| | | | 10 | 1 | | | 74 | 239 |
| | | | | | | | 81 | 239 |
| | | | | | | | 81 | 239 |
| | | | | | | | 77 | 239 |
| | | | | | | | 72 | 239 |
| | | | | | | | 67 | 239 |
| | | | | | | | 61 | 239 |
| | | | | | | | 54 | 239 |
| | | | | | | | 48 | 239 |
| | | | | | | | 43 | 239 |
| | | | | | | | 38 | 239 |
| | | | | | | | 33 | 239 |
| | | | | | | | 30 | 239 |
| | | | | | | | 27 | 239 |
| | | | | | | | 24 | 239 |
| | | | | | | | 21 | 230 |
| | | | | | | | 15 | 130 |
| | | | | | | | 14 | 86 |
| | | | | | | | 13 | 58 |
| 21 | 5 | 5 | 100 | 2 | 400 | 1.0 | 1040 | 4850 |

## ASSUMPTIONS

3 PLATFORMS, 52 PROD'N WELLS + 1 SERVICE WELL PER 3 PROD'N WELLS
DRILLING RATE = 12 PROD'N WELLS PER YEAR PER PLATFORM
2 PLATFORMS STARTING AS SHOWN, 31 PROD'N WELLS
DRILLING RATE = 12 WELLS PER YEAR PER PLATFORM

## 4. SALE "89" MAXIMUM OIL AND GAS CASE

| CAL. YEAR | XPL & DEL WELLS ## | XPL & DEL WELLS RIGS | PLATS AND EQUIP (STARTS) | PROD & SV WELLS ## | PROD & SV WELLS RIGS | TRUNK P/L MILES | SHORE TERMS | PRODUCTION OIL MMBBL | PRODUCTION GAS BCF |
|---|---|---|---|---|---|---|---|---|---|
| 1984 | | | | | | | | 0 | 0 |
| 1985 | | | | | | | 0.1 | 0 | 0 |
| 1986 | 3 | 3 | | | | | | 0 | 0 |
| 1987 | 4 | 4 | | | | | | 0 | 0 |
| 1988 | 6 | 6 | | | | | | 0 | 0 |
| 1989 | 6 | 6 | | | | | | 0 | 0 |
| 1990 | 4 | 4 | 1 | | | | 0.2 | 0 | 0 |
| 1991 | 3 | 3 | 1 | | | 100 | 0.3 | 0 | 0 |
| 1992 | 3 | 3 | 1 | 24 | 2 | 100 | 0.2 | 0 | 0 |
| 1993 | 3 | 3 | 1 | 23 | 2 | 100 | 0.2 | 0 | 0 |
| 1994 | 3 | 3 | 1 | 36 | 3 | 100 | | [illegible] | 0 |
| 1995 | 2 | 2 | 1 | 25 | 2 | | | 55 | 96 |
| 1996 | 2 | 2 | 1 | 36 | 3 | | | 93 | 191 |
| 1997 | 2 | 2 | 0 | 25 | 2 | | | 111 | 303 |
| 1998 | 1 | 1 | 2 | 36 | 3 | | | 149 | 398 |
| 1999 | | | 0 | 34 | 2 | | | [illegible] | 506 |
| 2000 | | | 1 | 32 | 3 | | | 199 | 598 |
| 2001 | | | | 22 | 2 | | | 210 | 614 |
| 2002 | | | | 24 | 2 | | | 238 | 614 |
| 2003 | | | | 22 | 2 | | | 244 | 614 |
| 2004 | | | | 24 | 2 | | | [illegible] | [illegible] |
| 2005 | | | | 9 | 1 | | | 271 | 614 |
| 2006 | | | | | | | | 255 | 614 |
| 2007 | | | | | | | | 239 | 614 |
| 2008 | | | | | | | | 219 | 614 |
| 2009 | | | | | | | | [illegible] | [illegible] |
| 2010 | | | | | | | | 180 | 614 |
| 2011 | | | | | | | | 159 | 614 |
| 2012 | | | | | | | | 140 | 614 |
| 2013 | | | | | | | | 124 | 614 |
| 2014 | | | | | | | | [illegible] | [illegible] |
| 2015 | | | | | | | | 97 | 614 |
| 2016 | | | | | | | | 86 | 614 |
| 2017 | | | | | | | | 76 | 609 |
| 2018 | | | | | | | | 67 | 578 |
| 2019 | | | | | | | | [illegible] | [illegible] |
| 2020 | | | | | | | | 52 | 454 |
| 2021 | | | | | | | | 46 | 373 |
| 2022 | | | | | | | | 0 | 295 |
| 2023 | | | | | | | | 0 | 200 |
| | 42 | 6 | 10 | 372 | 2 | 400 | 1.0 | 4150 | 14940 |

ASSUMPTIONS

OIL: 6 PLATFORMS, 207 PROD'N WELLS + 1 SERVICE WELL PER # PROD'N WELLS
DRILLING RATE = 24 PROD'N WELLS PER YEAR PER PLATFORM

GAS: 4 PLATFORMS, 96 PROD'N WELLS
DRILLING RATE = 12 WELLS PER YEAR PER PLATFORM

Expenditures

| | | (1982 $) |
|---|---|---|
| 1. | Exploration wells; per average well | $20 MM |
| 2. | Delineation wells; per average well | $12 MM |
| 3. | Production and service wells, per well | $ 5 MM |
| 4. | Production platforms; per platform, 450' water | $290 MM |
| 5. | Exploration support base | $25 MM |
| 6. | Production terminal, stand-alone | $2000/B/D peak |
| 7. | Pipelines; per mile | $1.0-2.4 MM |

Transportation Costs

The estimated transportation cost to shore by pipeline for oil may range between $4.20/Bbl oil for the low case to $0.32/Bbl oil in the maximum case.

The estimated transportation cost to shore by pipeline for gas may be between $0.85/MCF for the medium case to $0.50/MCF for high and maximum cases.

Mud and Drill Cuttings

The average exploratory well will use about 900 dry tons of mud solids, which will be disposed of in an approved manner. It will also produce about 1800 dry tons of drill cuttings, which will be disposed of in an approved manner.

The average production well will use about 900 dry tons of mud solids, most of which will be recycled to other production wells. It will also produce about 1800 dry tons of drill cuttings, which will be disposed of in an approved manner.

Charles L. Wilson

Harry Akers, Jr.

Stephen D. Adams

United States Department of the Interior
MINERALS MANAGEMENT SERVICE
ALASKA OCS REGION
Mailing Address: P.O. Box 101159
Anchorage. AK 99510

SEP 27 1984

Memorandum

To: Regional Supervisor, Leasing and Environment

From: Regional Supervisor, Resource Evaluation

Subject: Revision of Sale 89 Exploration and Development Report

The recently revised resource estimates for the Sale 89 planning area reflect significantly different values from the previous estimates. Revised schedules for this sale have been prepared and are attached.

R. H. McMullin

3 Attachments

SALE 89

Medium CASE, --- ALTERNATIVE

ESTIMATED SCHEDULE OF EXPLORATION, DEVELOPMENT, PRODUCTION

| SALE YEAR | CAL. YEAR | EXPLORATION WELLS | DELINEATION WELLS Oil | DELINEATION WELLS Gas | EXPLORATION/ DELINEATION DRILLING UNITS | PRODUCTION PLATFORMS AND EQUIPMENT Oil | PRODUCTION PLATFORMS AND EQUIPMENT Gas | PRODUCTION AND SERVICE Wells Oil | PRODUCTION AND SERVICE Wells Gas | PRODUCTION AND SERVICE Rigs | TRUNK PIPELINE MILES oil | TRUNK PIPELINE MILES Gas | NUMBER OF SHORE BASES* | PRODUCTION oil MMB | PRODUCTION Gas BCF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1985 | | | | | | | | | | | | | | |
| 1 | 86 | 1 | | | 1 | | | | | | | | | | |
| 2 | 81 | 2 | 1 | | 2 | | | | | | | | | | |
| 3 | 88 | 2 | 2 | | 3 | | | | | | | | | | |
| 4 | 89 | 2 | 1 | | 3 | | | | | | | | | | |
| 5 | 1990 | 2 | 2 | 1 | 5 | 1 | | 4 | | 1 | | | | | |
| 6 | 91 | 2 | 2 | 2 | 6 | 2 | | 12 | | 3 | | | | | |
| 7 | 92 | 1 | 1 | 2 | 3 | 1 | 2 | 24 | 6 | 5 | | | 0.2 | | |
| 8 | 93 | | | 1 | 1 | 1 | 2 | 16 | 12 | 5 | 100 | | D.3 | | |
| 9 | 94 | | | | | | 1 | 6 | 16 | 3 | 100 | | 0.3 | 0 | |
| 10 | 95 | | | | | | 1 | | 8 | 2 | | 100 | 0.2 | 28 | |
| 11 | 96 | | | | | | | | 4 | 1 | | 100 | | 94 | 0 |
| 12 | 97 | | | | | | | | | | | | | 94 | 350 |
| 13 | 98 | | | | | | | | | | | | | 94 | 442 |
| 14 | 99 | | | | | | | | | | | | | 94 | 442 |
| 15 | 2000 | | | | | | | | | | | | | 94 | 442 |
| 16 | 01 | | | | | | | | | | | | | 94 | 442 |
| 17 | 02 | | | | | | | | | | | | | 83 | 442 |
| 18 | 03 | | | | | | | | | | | | | 73 | 442 |
| 19 | 04 | | | | | | | | | | | | | 64 | 442 |
| 20 | 05 | | | | | | | | | | | | | 54 | 442 |
| 21 | 06 | | | | | | | | | | | | | 48 | 442 |
| 22 | 07 | | | | | | | | | | | | | 41 | 442 |
| 23 | 08 | | | | | | | | | | | | | 36 | 442 |
| 24 | 09 | | | | | | | | | | | | | 33 | 442 |
| 25 | 2010 | | | | | | | | | | | | | 29 | 442 |
| 26 | 11 | | | | | | | | | | | | | 26 | 442 |
| 27 | 12 | | | | | | | | | | | | | 24 | 442 |
| 28 | 13 | | | | | | | | | | | | | 21 | 442 |
| 29 | 14 | | | | | | | | | | | | | 0 | 442 |
| 30 | 15 | | | | | | | | | | | | | | 442 |
| -m-- | 16 | | | | | | | | | | | | | | 356 |
| 32 | 17 | | | | | | | | | | | | | | 265 |
| 33 | 18 | | | | | | | | | | | | | | 173 |
| 34 | 19 | | | | | | | | | | | | | | 100 |
| 35 | 2020 | | | | | | | | | | | | | | 0 |
| TOTAL | | 12 | 9 | 6 | ----------- | 5 | 6 | 62 | 46 | ------ | 200 | 200 | 1.0* | 1124 | 9200 |

*Total represents 50% of an oil terminal and 50% of an LNG plant (cumulative development with Sale 70).

SALE 89
Low CASE, --- ALTERNATIVE
ESTIMATED SCHEDULE OF EXPLORATION, DEVELOPMENT, PROOUCTION

| SALE YEAR | CAL. YEAR | EXPLORATION WELLS | DELINEATION WELLS | | EXPLORATION/ DELINEATION DRILLING UNITS | PRODUCTION PLATFORMS AND EQUIPMENT | | PRODUCTION AND SERVICE | | | TRUNK PIPELINE MILES | | NUMBER OF SHORE BASES* | PRODUCTION | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Oil | Gas | | oil | Gas | We 1S oil | Gas | Rigs | Oil | Gas | | Oil MMB | Gas BCF |
| 0 | 1985 | | | | | | | | | | | | | | |
| 1 | 86 | 1 | | | 1 | | | | | | | | | | |
| 2 | 87 | 2 | 1 | | 2 | | | | | | | | | | |
| 3 | 8a | 2 | 1 | | 2 | | | | | | | | | | |
| 4 | 89 | 1 | 1 | 1 | 3 | | | | | | | | 0.2 | | |
| 5 | 1990 | 1 | 1 | 1 | 3 | 1 | | 4 | | 1 | | | 0.3 | | |
| 6 | 91 | | | 1 | 1 | 1 | 1 | 10 | 4 | 3 | 100 | | 0.2 | | |
| 7 | 92 | | | | | | 1 | 7 | 6 | 3 | 100 | | 0.3 | 0 | |
| 8 | 93 | | | | | | 1 | | 6 | 2 | | 100 | | 9 | |
| 9 | 94 | | | | | | | | 1 | 1 | | 100 | | 31 | o |
| 10 | 95 | | | | | | | | | | | | | 31 | 129 |
| 11 | 96 | | | | | | | | | | | | | 31 | 163 |
| 12 | 97 | | | | | | | | | | | | | 31 | 163 |
| 13 | 98 | | | | | | | | | | | | | 31 | 163 |
| 14 | 99 | | | | | | | | | | | | | 31 | 163 |
| 15 | 2000 | | | | | | | | | | | | | 26 | 163 |
| 16 | 01 | | | | | | | | | | | | | 23 | 163 |
| 17 | 02 | | | | | | | | | | | | | 20 | 163 |
| 18 | 03 | | | | | | | | | | | | | 18 | 163 |
| 19 | 04 | | | | | | | | | | | | | 15 | 163 |
| 20 | 05 | | | | | | | | | | | | | 13 | 163 |
| 21 | 06 | | | | | | | | | | | | | 12 | 163 |
| 22 | 07 | | | | | | | | | | | | | 11 | 163 |
| 23 | 08 | | | | | | | | | | | | | 10 | 163 |
| 24 | 09 | | | | | | | | | | | | | 8 | 163 |
| 25 | 2010 | | | | | | | | | | | | | 8 | 163 |
| 26 | 11 | | | | | | | | | | | | | | 163 |
| 27 | 12 | | | | | | | | | | | | | 0 | 163 |
| 28 | 13 | | | | | | | | | | | | | | 163 |
| 29 | 14 | | | | | | | | | | | | | | 135 |
| 30 | 15 | | | | | | | | | | | | | | 100 |
| 31 | 16 | | | | | | | | | | | | | | 65 |
| 32 | 17 | | | | | | | | | | | | | | 37 |
| 33 | 13 | | | | | | | | | | | | | | 0 |
| 34 | 19 | | | | | | | | | | | | | | |
| 35 | 2020 | | | | | | | | | | | | | | |
| TOTAL | | 7 | 4 | 3 | ------- ---- | 2 | 3 | 21 | 17 | ----- | 200 | 200 | 1.0* | 366 | 3400 |

* Total represents 50% of an oil terminal and 50% of an LNG plant (cumulative development with Sale 70).

SALE 89

High CASE, --- ALTERNATIVE

ESTIMATED SCHEDULE OF EXPLORATION, DEVELOPMENT, PRODUCTION

| SALE YEAR | CAL. YEAR | EXPLORATION WELLS | DELINEATION WELLS Oil | DELINEATION WELLS Gas | EXPLORATION/ DELINEATION DRILLING UNITS | PRODUCTION PLATFORMS AND EQUIPMENT Oil | PRODUCTION PLATFORMS AND EQUIPMENT Gas | PRODUCTION AND SERVICE Wells Oil | PRODUCTION AND SERVICE Wells Gas | PRODUCTION AND SERVICE Rigs | TRUNK PIPELINE MILES Oil | TRUNK PIPELINE MILES Gas | NUMBER OF SHORE BASES* | PRODUCTION Oil MMB | PRODUCTION Gas BCF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1985 | | | | | | | | | | | | | | |
| 1 | 86 | 2 | | | 2 | | | | | | | | | | |
| 2 | 87 | 3 | 1 | | 3 | | | | | | | | | | |
| 3 | 88 | 4 | 2 | 2 | 6 | | | | | | | | | | |
| 4 | 89 | 4 | 3 | 2 | 7 | | | | | | | | | | |
| 5 | 1990 | 3 | 2 | 3 | 6 | 2 | | 8 | | 2 | | | | | |
| 6 | 91 | 3 | 2 | 3 | 6 | 2 | 2 | 30 | 8 | 6 | | | | | |
| 7 | 92 | 3 | 1 | 1 | 4 | 2 | 2 | 30 | 16 | 7 | | | | | |
| 8 | 93 | 3 | 1 | 1 | 4 | 2 | 2 | 30 | 20 | 7 | | | 0.3 | | |
| 9 | 94 | | | 1 | 1 | 1 | 3 | 14 | 20 | 6 | 125 | | 0.2 | | |
| 10 | 95 | | | | | | 2 | 8 | 16 | 3 | 100 | | 0.3 | 0 | |
| 11 | 96 | | | | | | 1 | | 10 | 2 | | 125 | 0.2 | 52 | |
| 12 | 91 | | | | | | | | 4 | 1 | | 10C | | 173 | 0 |
| 13 | 98 | | | | | | | | | | | | | 173 | 718 |
| 14 | 99 | | | | | | | | | | | | | 173 | 907 |
| 15 | 2000 | | | | | | | | | | | | | 1?3 | 907 |
| 16 | 01 | | | | | | | | | | | | | 173 | 907 |
| 17 | 02 | | | | | | | | | | | | | 173 | 907 |
| 18 | 03 | | | | | | | | | | | | | 153 | 907 |
| 19 | 04 | | | | | | | | | | | | | 134 | 907 |
| 20 | 05 | | | | | | | | | | | | | 118 | 907 |
| 21 | 06 | | | | | | | | | | | | | 100 | 907 |
| 22 | 07 | | | | | | | | | | | | | 85 | 907 |
| 23 | 08 | | | | | | | | | | | | | 74 | 907 |
| 24 | 09 | | | | | | | | | | | | | 66 | 907 |
| 25 | 2010 | | | | | | | | | | | | | 60 | 907 |
| 26 | 11 | | | | | | | | | | | | | 55 | 907 |
| 2? | 12 | | | | | | | | | | | | | 47 | 907 |
| 28 | 13 | | | | | | | | | | | | | 43 | 907 |
| 29 | 14 | | | | | | | | | | | | | 39 | 907 |
| 30 | 15 | | | | | | | | | | | | | 0 | 907 |
| 31 | 16 | | | | | | | | | | | | | | 907 |
| 32 | 17 | | | | | | | | | | | | | | 739 |
| 33 | 18 | | | | | | | | | | | | | | 550 |
| 34 | 19 | | | | | | | | | | | | | | 359 |
| 35 | 2020 | | | | | | | | | | | | | | 208 |
| 36 | 21 | | | | | | | | | | | | | | 0 |
| TOTAL | | 25 | 12 | 13 | ----------- | 9 | 12 | 20 | 94 | ----- | 225 | 225 | 1.0* | ?064 | 18900 |

*Total represents 50% of a oil terminal and 50% of an LNG piant (cumulative development with Sale 70).

# Appendix B-2

## Scenario

## . ALTERNATIVES INCLUDING THE PROPOSED ACTION

.is section describes the proposed action and the alternatives to the pro- ısal for St. George Basin (Sale 89). It also outlines the production assump- .ons, development estimates, resource estimates, and mitigating measures ıich shape the environmental analysis contained within this document.

A. Resource Estimates: The development strategies discussed in ıis section are based on the conditional resource estimates and the develop- ınt and production schedule found in Tables 11-1 and 11-2. The analysis :esented in the proposed action is based on the mean resource estimate. The ıximum and minimum resource estimates are analyzed in Appendices A and B :spectively. These estimates are unrisked in terms of the probability of :source discovery. The marginal probability of a commercial hydrocarbon .scovery is 22 percent.

'e resource estimates are based on primary production methods. Differing ısumptions regarding both economic and engineering factors will affect the ;timate of recoverable resources. Economic factors include exploration and :velopment costs, operating expenses, price and market value for oil and ıtural gas, taxes, depreciation, and royalty and production rates. Included ıong the engineering factors are reservoir thickness and area, properties of : hydrocarbon-bearing rocks, feasibility and effectiveness of pressure ıintenance through secondary and tertiary recovery, well spacing, deviation ı depth, climate, surficial geology and other environmental factors affecting ıe design and technology of surface drilling, and development and production ›erations.

ıitional information on the methodology of resource appraisal can be found ı Geological Survey Circular 860 and Geological Survey Open-File Report 1-1151.

B. Development Strategies: There are many development and trans- mutation scenarios which could be developed for the environmental analysis of ..is EIS. The selection made by MMS resulted from discussions within MMS, ith other government agencies, and with industry. It represents a ross-section of the different, feasible options. in developing these cenarios, the locations of existing infrastructure, the locations of sites ith potential as support facilities, the area resource estimates, and the cenarios developed for the previous OCS Sales in the Bering Sea are all onsidered.

ince any future development of oil and gas resources in the Bering Sea ontain numerous uncertainties, the scenarios for Sale 89 were developed ndependently of any past or proposed OCS sales in this area. However, if evelopment should occur as the result of a discovery in the Sale 70 leased racts or in the proposed Sale 92 area, the infrastructure in place or under instruction could be used, or shared, in developing the oil and gas resources ssociated with this proposal (Sale 89).

hen describing the scenarios developed for this lease sale, the St. George 'sin Planning Area is divided into a northern and a southern subunit. stimates of resources for the entire planning area are split equally between he subunits (Fig.II-1).

## Table II-1
Resource Comparison of the Proposal and Each Alternative
(Conditional-Unrisked)

| Resource | Minimum | Alternative 1 Proposal Mean | Maximum | Alternative III Pribilof Islands Deferral | Alternative IV Unimak Pass Deferral | Alternative VI Aleutian Islands Deferral | **Marginal (1) Probability (Mean Case Only) |
|---|---|---|---|---|---|---|---|
| Oil, MMB | 366 | 1124* | 2046 | 1124* | 1124* | 1124* | 0.22 (Hydrocarbons) |
| Gas, BCF | 3400 | 9200 | 18900 | 9200 | 9200 | 9200 | |

Source: MMS, 1984.

*The resource estimates do not change between alternatives because there are no known significant unleased prospects in the deferral areas.

**The marginal probability of success is the subjective probability that- economically recoverable (i.e., marketable) accumulations of hydrocarbons do exist in at least one prospect in the area under consideration.

Table 11-2
St. George [illegible] (Sa[illegible] 9)
Mean Oil Case

| SALE YEAR | CAL. YEAR | EXPLORATION WELLS | DELINEATION WELLS Oil | DELINEATION WELLS Gas | EXPLORATION/ DELINEATION DRILLING UNITS | PRODUCTION PLATFORMS AND EQUIPMENT Oil | PRODUCTION PLATFORMS AND EQUIPMENT Gas | PRODUCTION AND SERVICE Wells Oil | PRODUCTION AND SERVICE Wells Gas | PRODUCTION AND SERVICE Rigs | TRUNK PIPELINE MILES Oil | TRUNK PIPELINE MILES Gas | NUMBER OF SHORE BASES | PRODUCTION Oil MMB | PRODUCTION Gas BCF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1905 | | | | | | | | | | | | | | |
| 1 | 86 | 1 | | | 1 | | | | | | | | | | |
| 2 | 01 | 2 | 1 | | 2 | | | | | | | | | | |
| 3 | 88 | 2 | 2 | | 3 | | | | | | | | | | |
| 4 | 89 | 2 | 1 | | 3 | | | | | | | | | | |
| 5 | 1990 | 2 | 2 | | 5 | 1 | | 4 | | 1 | | | | | |
| 6 | 91 | 2 | 2 | | 6 | 2 | | 12 | / | 3 | | | | | |
| 7 | 92 | 1 | 1 | 2 | 1 | 1 | 1 | 24 | 6 | 5 | | | 0.5 | | |
| 8 | 93 | | | 1 | 1 | 1 | 2 | 16 | 12 | 5 | | | 0.5 | | |
| 9 | 94 | | | | | | 1 | 6 | 16 | 3 | 100 | | 1.0 | 0 | |
| 10 | 95 | | | | | | 1 | | 8 | 2 | | 200 | 1.0 | | |
| 11 | 96 | | | | | | | | 4 | 1 | | 100 | | % | 7 |
| 12 | 97 | | | | | | | | | | | | | 94 | 350 |
| 13 | 9n | | | | | | | | | | | | | 94 | 442 |
| 14 | 99 | | | | | | | | | | | | | 94 | 442 |
| 15 | 2000 | | | | | | | | | | | | | 94 | 442 |
| 16 | 01 | | | | | | | | | | | | | 94 | 442 |
| 17 | 02 | | | | | | | | | | | | | 83 | 442 |
| 18 | 03 | | | | | | | | | | | | | 73 | 442 |
| 19 | 04 | | | | | | | | | | | | | 64 | 442 |
| 20 | 05 | | | | | | | | | | | | | 54 | 442 |
| 21 | 06 | | | | | | | | | | | | | 48 | 442 |
| 22 | 07 | | | | | | | | | | | | | 41 | 442 |
| 23 | 08 | | | | | | | | | | | | | 36 | 442 |
| 24 | 09 | | | | | | | | | | | | | 33 | 442 |
| 25 | 2010 | | | | | | | | | | | | | 29 | 442 |
| 26 | 11 | | | | | | | | | | | | | 26 | 442 |
| 27 | 12 | | | | | | | | | | | | | 24 | 442 |
| 28 | 13 | | | | | | | | | | | | | 21 | 442 |
| 29 | 14 | | | | | | | | | | | | | 0 | 442 |
| 30 | 15 | | | | | | | | | | | | | | 442 |
| 31 | 16 | | | | | | | | | | | | | | 15 r |
| 32 | 17 | | | | | | | | | | | | | | ?65 |
| 33 | 18 | | | | | | | | | | | | | | 173 |
| 34 | 19 | | | | | | | | | | | | | | 100 |
| 35 | 2020 | | | | | | | | | | | | | | 0 |
| TOTAL | | 12 | 9 | h | | 5 | 6 | 62 | 46 | | 100 | 300 | 3.0* | 1124 | 9200 |

* Includes 2 LNG plants and one oil storage and loading terminal.

SOURCE: MMS, 1984.

The primary development scenario for the northern subunit assumes that all oil and gas will be piped ashore to St. George Island. Tankers could transport all resources directly from the island to the market. The marine- and air-support bases for these operations could be located at Unalaska/Dutch Harbor, Cold Bay, and St. George Island.

Although present infrastructure on St. George Island is limited, the island was selected as the hypothetical landfall for the pipelines in this northern scenario because of its proximity to the primary areas of interest.

Offshore loading would be the primary development scenario for oil in the southern subunit. All oil would be transported directly from the offshore facilities to market via tanker.

All gas in the southern area would be piped to a landfall at Herendeen Bay and then transported overland, via pipeline, to an LNG plant at Balboa Bay. The processed gas would be transported directly to market by LNG tanker.

Facility locations and transportation scenarios discussed in this EIS represent assumptions that were made as a basis for identifying characteristic activities and any resulting environmental effects. These assumptions do not represent an MMS recommendation, preference, or endorsement of any facility, site, or development plan.

Additional details describing the development scenario for this lease sale can be found in Section IV.A.1.

C. Description of the Proposal and Alternatives:

1. Alternative I - Proposal:

a. Description of the Proposal: The proposed action for this alternative is the offering of all unleased blocks within the St. George Basin Planning Unit (Fig. II-1). The area offered covers approximately 28,208,078 hectares and contains 12,529 blocks. In addition, there are 96 blocks in the area leased for Sale 70. These blocks are located from about 6 to 436 kilometers offshore. Water depths range from approximately 30 meters to 3,200 meters.

The conditional undiscovered mean recoverable estimate for oil and gas for this proposal is 1124 MMB of oil and 9200 BCF of gas. The marginal probability of success is 22 percent (Table II-1).

The analysis of expected effects is summarized below and described in detail in Section IV. This analysis is based on development scenarios formulated to provide a set of assumptions and estimates on the amounts, locations, and timing for OCS exploration, development, and production operations and facilities, both on- and offshore. The development scenario used in analyzing the proposed action is described in detail in Section IV.A.1. A summary of the major assumptions (see Table II-3) follows:

Table II-3
Summary of Basic Scenario Assumptions Regarding
Estimated OCS-Related Activities in the
St. George Basin

| PHASE<br>cility or Event | SALE 89 MEAN CASE<br>Number or Amount | Time-Frame | SALE 70 MEAN CASE<br>Number or Amount | Time-Frame |
|---|---|---|---|---|
| ORATION | | | | |
| ploration Wells | 12 | 1986-1992 | | |
| lineation Wells | | | 55 | 1983-1989 |
| Oil | 9 | 1987-1992 | | |
| Gas | 6 | 1990-1993 | . . | --- |
| 1 Drilling Muds & Cuttings | | | | |
| rilling Muds-Tons | 28,350 | | | |
| Cuttings-Tons | 18,900 | | | |
| mic Activity (trackline miles) | 4,313 | | 7,491 | |
| copter Flights | 120 | | 300 | |
| ly-Boat Trips | 60 | | 150 | |
| LOPMENT | | | | |
| UCTION | | | | |
| Likely Number of Oil Spills | | | | |
| 1,000 barrels or greater | 3 | | 1 | |
| less than 1,000 barrels | 298* | | 297* | |
| orce-Peak Year | | | | |
| form Installation | 5 | 1990-1993 | u | 1985-1990 |
| uction & Service | | | | |
| Well Drilling | 62 | 1990-1994 | 251 | 1987-1991 |
| uction | | | | |
| 1 MMBbls | 1,124 | 1994-2014<br>1996-2001 | 1,120 | 1989-2010<br>1991 |
| early-MMbbls | 04 | | 242 | |
| aily-Barrels | 257,534 | | 663,014 | |
| (pipeline | | | | |
| ffshore | 89 | | | |
| nshore | 0 | | | |
| form Installation | 6 | 1992-1995 | | |
| uction and Service | | | | |
| ll Drilling | 46 | 1992-1996 | | |
| uction | | | | |
| - BCF | 9,200 | 1996-2020<br>1998-203.5 | 3,660 | 1989-2019<br>1993 |
| early - BCF | | | 256 | |
| ly ($m^3$) | 1,210,% | | 701,370 | |
| G ($m^3$) | | | | |
| Drilling Muds & Cuttings | | | | |
| illing Muds-Tons | 14,700 | | | |
| ttings-Tons | 9,800 | | | |
| ic Activity (trackline miles) | 1,440 | | 2,428 | |
| opter Flights | 120 | | 300 | |
| y Boat Trips | | | | |
| nthly Maximum | 60 | | 150 | |
| orce During velopment Phase | 25,00-3,000[1/] | | 6',000 | |
| pipeline | | | | |
| fshore | 260 ml | | | |
| shore | 40 mi | | | |

Table II-3
Summary of Basic Scenario Assumptions Regarding
Estimated OCS-Related Activities in the
St. George Basin

| PHASE<br>Facility or Event | SALE 89 MEAN CASE<br>Number or Amount | SALE 89 MEAN CASE<br>Time-Frame | SALE 70 MEAN CASE<br>Number or Amount | SALE 70 MEAN CASE<br>Time-Frame |
|---|---|---|---|---|
| Total Support Activity for the Development Phase | | | | |
| Helicopter Trip | 120 | | 240 | |
| Supply Boat Trips | | | | |
| Monthly Maximum | 60 | | 180 | |
| Support Facilities-Shore Based Facilities | 136 | | 200 | |
| Total Allocated Hectares | | | | |
| Oil 'Terminal (1) | 40 | | 120 | |
| Gas Terminal (2) | 80 | | 80 | |
| Shorebase | 16 | | 16 | |
| Tanker Transportation (Peak Production) | | | | |
| Crude Oil | 5 2/ | | 1.25 | |
| Terminal Callrate-Day | 146 3/ | | 292 | |
| Number of Trips Annually | 6 4/ | | 4 | |
| LNG | | | | |
| Number of Trips Annually | 60 | | 92 | |

Source: M?Is, 1985.

*Based on Cook Inlet spill rate for spills under 1,000 barrels (265 spills per billion barrels of produced oil), the average size of spills in this size category is 4.4 barrels.

1/ Workforce numbers represent an average monthly rate. Seasonal construction requirements will tend to cause higher level of summer employment.

2/ Figures for both Sales 89 and 70 were calulated for tankers in the 1C:-150 DWT class.

3/ Trips should be evenly divided between the two terminals.

4/ LNG tankers rates for both sales are estimated for vessels of the 135,000M$^3$ class.

Note: Gas terminals are assumed at St. George and Balboa Bay. An oil terminal is assumed at St. George for the northern subunit and offshore loading is assumed for the southern subunit.

- Environmental, social, and economic effects may occur as a result of a federal decision to permit exploration for offshore oil and gas resources.

- The St. George Basin Planning Area will be divided into a northern and a southern subunit.

- Exploratory drilling could be limited to the open-water season. Drilling would probably be carried out by heavy-duty semi-submersibles. Drillships are a possibility.

- All oil and gas produced in the northern subunit would be piped to onshore facilities on St. George Island.

- All oil in the southern subunit would be produced using offshore loading technology.

- All gas in the southern subunit would be piped to a landfall at Herendeen Bay and then transported overland to an LNG plant at Balboa Bay.

- Tankers would transport oil and gas from St. George Island directly to the market.

- Tankers would transport oil from offshore loading facilities directly to the market.

- The resource estimates will be split equally between the northern and southern subunits.

- Twenty-seven exploration and delineation wells will be drilled during the period 1986 to 1993.

- Oil production would begin in 1994 and reach peak annual production in 1996 (94 MMB).

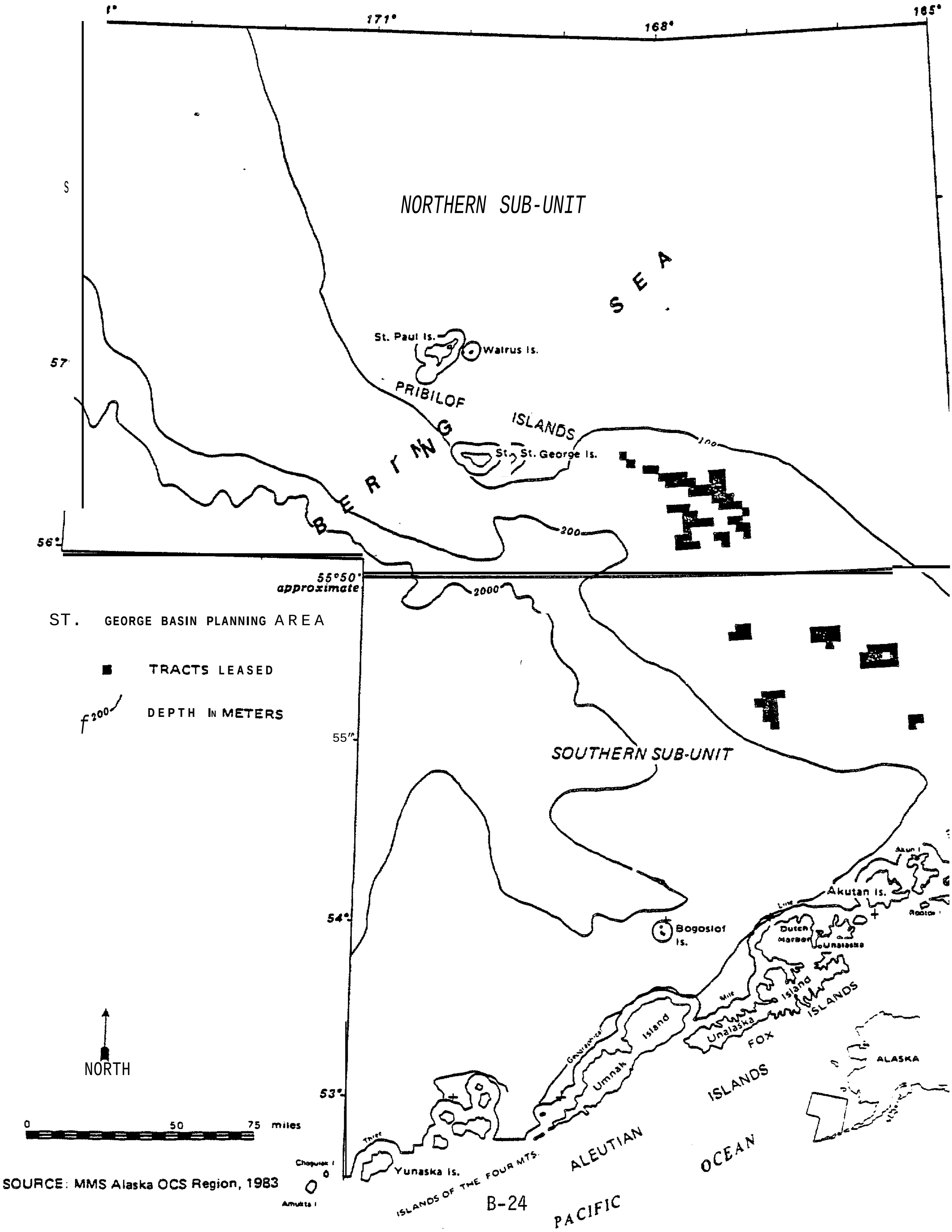
- During exploration, development, and production, Unalaska/Dutch Harbor, Cold Bay and St. George would probably seine as onshore marine- and air-support facilities.

Because of the numerous uncertainties associated with any development of oil and gas resources in the Bering Sea major differences do exist between the scenarios developed for the first St. George Basin Sale (Sale 70) and those described in this EIS (Sale 89). The proposal for Sale 70 is based entirely on the use of marine pipelines transporting recoverable hydrocarbons from the St. George Basin to a landfall on the north side of the Alaska Peninsula. Included in that scenario was an overland pipeline which would then transport the oil and gas to a hypothetical storage and processing facilities on the south side of the peninsula.

However, since that EIS (Sale 70) was released to the public there have been some indications that long pipelines may be the least economically attractive option. A study prepared for MMS by Han-Padron Associates, "Evaluation of Bering Sea Crude Oil Transportation Systems" (MMS 84-0027), concluded that the

Figure I I-I

DESCRIPTION OF THE PROPOSAL



optimum crude oil transportation system for the Bering Sea is based on offshore loading technology. Several members of the oil and gas industry have also indicated an interest in the use of offshore loading for developing the Bering Sea. An offshore loading scenario is evaluated in the minimum case (Appendix B). Others still perfer marine pipelines.

Therefore, since both options are feasible and there are numerous uncertainties associated with any development in the Bering Sea at this time, the scenario for Sale 89 includes pipelines for the development of the northern half of the planning unit and offshore loading of crude oil in the southern half.

## IV. ENVIRONMENTAL CONSEQUENCES

### A. Basic Assumptions for Effects Assessment

1. Development Scenarios: The development scenario used in the analysis of this lease sale provides a hypothetical framework of assumptions and estimates on the amounts, schedules, and locations for onshore and offshore oil and gas facilities. It represents assumptions that were made to identify characteristic activities and any resultant effects on the environment. A summary of these assumptions can be found in Table S-3. These assumptions do not represent a Minerals Management Semite recommendation, preference, or endorsement of any facility, site, or development plan.

The proposed action for this proposal (Alternative 1) is the offering of all unleased blocks within the St. George Basin (Sale 89) Planning Area. This area covers approximately 28,208,078 hectares (70 million acres) and contains 12,529 unleased blocks. There are also 96 blocks in the Planning Area which were leased in Sale 70.

Since there is a great deal of uncertainty associated with future oil and gas development in the Bering Sea, the scenarios for Sale 89 were developed independently of the hypothetical development discussed in the St. George Basin Sale 70 final EIS (DOI, 1982) and for the North Aleutian Basin (Sale 92) EIS. However, if development should occur as the result of a discovery in either of these areas, it could be possible for the infrastructure in place or under construction to be used for developing the Sale 89 leases. See Table IV-1 for a summary of hypothetical petroleum industry activities in the St. George Basin Planning Area. "

Basic assumptions for the analysis of this scenario are:

- The planning area for this proposed sale will be divided into northern and southern subunits. All oil and gas produced in the northern subunit will be piped to a landfall and terminal facilities on St. George Island. In the southern subunit, all oil will be developed using offshore loading technology, and gas will be piped ashore at Herendeen Bay on the Alaska Peninsula. From Herendeen Bay, gas will be piped overland to an LNG plant at Balboa Bay.

- The mean boundary between the two development subunits is shown on Figure II-1.

- The conditional undiscovered recoverable estimates for the Sale 89 Planning Area are 1.124 Bbbls of oil and 9.20 TCF of gas. Equal amounts could be discovered in both northern and southern subunits.

Additional information regarding the resource estimates and development schedules can be found in Sections II.A. and II.B.

A summary of the major assumptions and estimates can be found in Section II.C.

## Table IV-1
Summa ry of Hypothetical Industry Activities in the : t. George Basin Planning Area

| HASE/ACTIVITY | stile 70 | Sale 89 |
|---|---|---|
| **XPLORATION** | | |
| Explorat ion and Delineat ion Drilling | Drilling would probably be carried out by heavy-duty semi-submersibles during the open water season. Drill ships are also a possibility. | |
| Support Bases | Marine Support-Dutch Harbor<br>Air Support-Cold Bay | Marine Support-Dut ch Harbor<br>Afr Support-Cold Bay nod St. George |
| Drilling and Seismic Activities | Exploration and delineation drilling will begin in, 1983 and end in 1987. A total of 55 wells could be drilled. The total estimated trackline miles of seismic data for this sale is approximately 7,491 miles. | Exploration and delineation drilling will begin in 1986 and end in 199?. A total of 27 wells will be drilled. The total estimated trackline miles of seismic data for Sale 89 is approximately 4,313 miles. |
| Muds and Cutt ings | | The estimated total amount of drilling mud is 28,350 Lens and of cuttings is 18,900 tons. |
| **EVELOPMENT AND RODUCTION** | | |
| Production Activity and Technology | Installation of 11 production plat forms is predicted to begin in 1905 and end 1989. From 1987 to 1991, an estimated 251 oil and gas production and service wells will he drilled. Production plat forms will probably h e steel structures. During the development phase, the estimated monthly number of helicopter flights would be 120 and supply-boat trips would be 10. | Installation of 5 oil and 6 gas production platforms is predicted to begin in 1990 and end in 1995. From 1990 to 1996, an estimated 62 011 and 46 gas roduction and service wells will be drilled. Large gravity structures with storage capability or steel jacket platforms might be selected as technology development. During the development phase, the total estimated number of helicopter flights would be 120 and supply-boat trips would he 60. |
| Production Terminals and Suppor t Bases | One LNG plant and oil storage and loading terminal on the south coast of the Alaska Peninsula. Air-support facilities at Cold Bay. Marine-support facilities at Dutch Harbor. | One LNG plant and oil storage and loading terminal will be located at St . George Island. Another LNG plant at Balboa Oay. Air-support facilities at St. George and Cold Ony. Marine-support facilities at Dutch Harbor. Limited marine facilities at St. George. |
| Production/Transportation Scenario | All oil and gas piped to a terminal on the south side of Alaska Peninsula. | A l l oil and gas developed in the northern half of the planning unit would be piped to facilities on St |

Table iV-1 (Continued)

umar Hyp- tica- dust ctiv s In - St. erge - Pl ig A

| PHASE/ACTIVITY | Sale 70 | Sale 09 |
|---|---|---|
| **DEVELOPMENT AND PRODUCTION (cont.)** | | |
| Production/Transportation Scenario (cont.) | | George Island. All oil in southern half-of planning unit would he developed using offshore loading technology. All gas developed in the south would be piped to a terminal at Balboa Bay. |
| Product 1011-011 1/ | Production starts in 1909 and continues until 2010. Penk production occurs in 1991. Total production is estimated to be 1,120 million barrels. | Production starts in 1994 and continues until 2014. Peak production is from 1996 to 2001.. Total production is estimated to he 1,124 million barrels. |
| Production-Gas 1/ | Production starts in 1989 and continues until 2019. Peak production occurs in 1993. Total production Is estimated to be 3,660 billion cubic feet. | Production starts in 1996 and continues until 2020. Peak production occurs between 1998 and 2015. Total production is estimated to be 9,200 billion cubic feet. |
| Most Likely Number of Oil Spills | 1 | 3 |
| Muds and Cuttings | | Drilling mud solids are estimated to be 14,700 Lens. Drill cuttings could reach 9,800 tons. |
| Tanker Transportation Crude Oil | Crude oil {s expected to be carried to s transshipment terminal on the south side of the Aleutian Peninsula by 9 0 0150,000 deadweight-ton, ice-breaking tankers. The oil would he carried from the transshipment terminal tc refineries outside Alaska. | |
| | During peak production, the number of tanker trips is estimated to be 146 per year. | During peak production, the number . of tanker trips is estimated to be 292 per year. |
| LNG | LNG Is expected to he carried to markets outside Alaska 10 ice-breaking tankers capable of carrying 135,000 . meters of LNG. | |
| | During peak production, the number of tanker trips Is estimated to be 60 per year. | During peak production, the number of tanker trips 1s estimated to be 92 per year. |

Source: MMS, Alaska OCS Region, 1985.

1/ The mean-case resource estimates for Sales 89 and 70 occur at different percentiles, thus they should not be added to obtain statistically valid estimates for the amounts of oil and gas in the entire basin. However, the difference between the mean percentiles is small enough so that the number of units for each of the activities shown in the table can be added to obtain a reasonable estimate of such scenario elements as the number of platform: installed and wells drilled or amount of pipe laid.

a. Exploration Infrastructure Estimates: During the exploratory phase, Cold Bay, Unalaska/Dutch Harbor, and St. George Island could serve as the support facilities for activities related to this lease sale.

Cold Bay could be the primary air-support base. Existing facilities are very good--the airport has two paved runways (10,415 and 5,126 ft long) and is equipped with navigational aids, lighting system, and adequate space for transit aircraft. In addition, Cold Bay is reasonably close to most of the sale area. Personnel and equipment could arrive in Cold Bay via large iet aircraft and be transported to offshore platforms via large helicopters, such as the Sikorsky S-61 or the Boeing 234.

Unalaska/Dutch Harbor, with its existing infrastructure and good anchorage, could be a primary site for all major marine-support operations.

Limited air-support operations could be conducted out of St. George Island during this phase. However, existing facilities would have to be expanded to handle the increased traffic. The present airstrip would have to be lengthened. Storage facilities, fuel bunkers, aircraft facilities, and quarters for personnel would need to be constructed. Navigational aids would be necessary to assist all air operations. It is estimated that at least three chartered flights per month would be needed to rotate drilling and support crews from St. George Island to the mainland U.S.

Marine support out of St. George Island could be extremely limited. At the present time, adequate harbor facilities do not exist. If industry decided to build marine facilities on the island, they would have to be capable of supporting two to four support boats or tugs at a time.

Exploratory drilling would probably be carried out either by drillships or by semisubmersibles and would be conducted during ice-free periods.

b. Development and Production Infrastructure Estimates: With the discovery of recoverable amounts of oil and gas resources, the support facilities used during the exploration phase would be expanded. The siting and construction of onshore production facilities could be initiated.

The primary scenario for the northern subunit would be is centered around the use of two trunk pipelines (100 mi each) to transport oil and gas from six offshore platforms (3 oil/3 gas) to a liquefaction, storage, and tanker-loading terminal on St. George Island.

The crude-oil terminal would require 35 to 40 hectares of land and would be self-contained. It would include living quarter, sewage treatment, power plant, and ballast-water-treatment facilities, and onshore storage for up to 10 davs of crude production (based on projected production rates in Table II-2.) The terminal should have the ability to handle a maximum production rate of 258 Mbbls of oil daily.

Oil from the St. George terminal would be transferred from the onshore facilities to tankers via an offshore single-point mooring system. Tanker loading would occur every 5 to 7 days. Tanker size is estimated at 120,000 DWT. All oil would be shipped directly to the market.

The liquefaction plant on St. George Island would require approximately 80 hectares of land and would be self supporting. The maximum daily production rate for the facilities could reach 1.211 BCF. The processed gas would be transported directly to the market by LNG tanker.

Marine facilities would be needed at St. George Island for workboats supporting the terminal operations. However, major marine support for the field would probably continue to operate out of Unalaska/Dutch Harbor. Bulk drilling materials could be shipped into this port for storage and reloading onto supply boats.

The production platforms used in the northern subunit could be steel-jacket or concrete/steel-gravity platforms. These would be designed as necessary to reduce ice loads. However, marine facilities would be needed at St. George Island for workboats/tugs supporting the terminal operations. Dock space would be necessary for two to four vessels.

In the southern subunit, all oil would be developed using offshore loading technology. Gas would be piped to a landfall at a hypothetical location such as Herendeen Bay and then piped overland to an LNG plant at Balboa Bay. At least one pump station will be needed at Herendeen Bay. A 160-mile gas pipeline would be necessary to transport gas from the production platforms to the Balboa Bay LNG Plant. The Bristol Bay Cooperative Management Plan (1984), Bristol Bay Plan for State Lands (State of Alaska, 1984) and Alaska Peninsula NWR Plan (USDOI , FWS 1984), identified a preferred transpeninsula transportation corridor from Herendeen Bay to Balboa Bay and recommended that it be developed for industrial and private use. The route would extend from Port Moller through Portage Valley to Balboa Bay. Depending on the port site selected, the route could range from 55 to 69 kilometers long. Port Moller and Herendeen Bays are shallow, with extensive mudflats and water depths averaging less than 4 meters; water depths in channels can exceed 18 meters. Tine pipeline is assumed to be buried for 8 to 13 kilometers in the port Moller/Herendeen Bay area. The overland pipeline route (about 20 km) follows the right-hand fork of Portage Valley River and descends into a narrow valley drained by Foster Creek into Left Hand Bay of Balboa Bay. The Bay--4 kilometers wide and 6.4 kilometers long--is considered a good anchorage for large vessels. A pipeline and construction-access road would probably require a 100-foot right-of-way (BBCMP, 1984). Pipeline development and maintenance would require air, ground, and marine support which could include helicopter, other aircraft, bulldozers, all-terrain vehicles, barges, and ships. Pipeline construction is expected to begin in 1993 and to be completed in 1994.

Two oil and three gas platforms are projected for the southern development strategy. Oil platforms could be large-gravity structures with storage capability or a steel-jacket platform with separate storage facilities. Gas platforms could be steel-jacket structures.

Cold Bay would be the primary air-support base for the southern subunit. Personnel and a limited amount of equipment could be transferred between this support base and the platforms by large long-range helicopters. In addition, all workers assigned to Balboa Bay, onshore pipeline maintenance, and the pump station at Herendeen Bay would. pass through Cold Bay.

Limited air-support facilities would be needed at Balboa Bay to handle personnel and cargo flights from Cold Bay.

Marine support for the southern development would occur out of Unalaska/Dutch Harbor. Since five platforms would be serviced out of this port limited expansion of existing facilities might be necessary.

Marine support facilities also would be needed to support the LNG terminal at Balboa Bay.

c. Development Timetable: The exploratory period could begin in 1986 and end in 1993. A total of 12 exploratory wells and 15 delineation (9 oil/6 gas) wells are projected to be drilled during that period (Table II-2).

The development period is projected to begin in 1990 with the construction of one offshore oil platform and the drilling of four wells. All oil platforms could be in place by 1994. Construction of six gas platforms could start in 1992 and be completed by 1995. Between 1990 and 1996 a total of 108 production and service wells (62 oil/46 gas) would be drilled in the entire planning unit.

Pipeline construction is expected to start in 1993 and be completed by 1996. The trunk lines in the northern subunit are each projected to be 100 miles in length. The gas line in the southern subunit could be 160 miles in length offshore and 40 ❑iles long overland.

Oil production is expected to begin in 1994. Peak production could occur between 1996 and 2001 with a yearly rate of 94 MMbbls. All oil production probably would cease during 2014.

Gas production is expected to begin in 1996 and end sometime during 2020. Between 1998 and 2015, the yearly production rate will be 442 BCF.

d. Estimated Production Effluents: Estimated amounts of production effluents include the discharge of an estimated 11.24 to 1,011.6 MMbbls of produced waters and an average of 60,500 gallons/day of treated sanitary and domestic wastes from platforms. Drilling mud solids are estimated to be 28,350 tons. Drill cuttings could reach 18,900 tons. Yearly estimates, as related to the production schedule (Table 11-2), can be found in Table IV-2.

e. Population Projections: The scenario for the St. George Basin (Sale 89) identifies the communities of Unalaska, Cold Bay, and St. George as potential hosts for petroleum-industry personnel and operations. Due to model limitations, it was possible only to make population projections for Unalaska and Cold Bay using the Rural Alaska Model (RAM) of the Institute of Social and Economic Research, University of Alaska (Nebesky and Knapp, 1984). Potential levels of employment and population growth were projected for these communities through the year 2010, representing a 30-year forecast period, for potential development under lease-sale conditions and without the lease sale. St. George was too small in population size to use the RAM forecasting model, but other means were used and a discussion is included on the potential levels of population with, and in the absence of, the lease

| Year | Produced Waters (MMbbls) | Exploration- and Delineation-Derived Solids Cuttings (t) | Muds (t) | Platform-Derived Domestic and Sanitary Wastes (gal./day) | Sediments Disturbed by Pipe-laying Activ. ($yd^3$) |
|---|---|---|---|---|---|
| 1985 | | | | | |
| 1986 | | 700 | 1 ,05(-) | | |
| 1987 | | 2,100 | 3,150 | | |
| 1988 | | 2,800 | 4,200 | | |
| 1989 | | 2,100 | 3,150 | | |
| 1990 | | 3, 500 | 5,250 | 5,500 | |
| 1991 | | 4,200 | 6,300 | 16,500 | |
| 1992 | | 2,800 | 4, 2(M) | 33,000 | 385,000-923,000 |
| 1993 | | 700 | 1,050 | 49,500 | 385,000-923,000 |
| 1994 | | | | 55,000 | 385,000-923,000 |
| 1995 | .280-25.2 | | | 60,500 | 385,000-923,000 |
| 1996 | .940-84.6 | | | 60,500 | |
| 1997 | .940-84.6 | | | 60,500 | |
| 1998 | .940-84.6 | | | 60,500 | |
| 1999 | .940-84.6 | | | 60,500 | |
| 2000 | .940-84.6 | | | 60,500 | |
| 2001 | .940-84.6 | | | 60,500 | |
| 2002 | .830-74.7 | | | 60 ,500 | |
| 2003 | .730-65.7 | | | 60,500 | |
| 2004 | .640-57.6 | | | 60,500 | |
| 2005 | .540-48.6 | | | 60,500 | |
| 2006 | .480-43.2 | | | 60,500 | |
| 2007 | .410-26.1 | | | 60,500 | |
| 2008 | .360-32.4 | | | 60,500 | |
| 2009 | .330-29.7 | | | 60,500 | |
| 2010 | .290-26.1 | | | 60,500 | |
| 2011 | .260-23.4 | | | 60,500 | |
| 2012 | .240-21.6 | | | 60,500 | |
| 2013 | .210-18.9 | | | 60,500 | |
| 2014 | | | | 33,000 | |
| 2015 | | | | 33, (X-N-I | |
| Totals | 11.24-1,011.6 | 18,900 | 28,350 | 60,500* | 1.54-3.69 Million |

*Dailv average for 11 platforms

Source: MMS. 1984.

sale. This discussion presents the population projections resulting from modeling and other means as conditions for considering a variety of potential social systems effects.

Base-Case Projections (Excluding the Lease Sale):

Base-case projections for Unalaska and Cold Bay (see Appendix I) do not include activities associated with the sale under consideration. However, the base case does include assumptions about activities in the St. George Basin (Sale 70) and Navarin Basin (Sale 83) areas, which are reflected in the category of "project enclave population" for the base case. The other active category of enclave population, "nonproject enclave population," is found largely in Unalaska and is comprised principally of personnel of the seafood-processing industry.

Under conditions of base-case projections, Unalaska experiences little movement in population growth over the first 8 to 10 years of the projection. This is followed by modest population increases, until a leveling trend appears near the turn of the century. During peak periods of OCS-related population presence (1987 and 1997), such enclave-type population accounts for not more than 7 to 11 percent of the total population of Unalaska. OCS-related population in Cold Bay accounts for a larger proportion of total population during peak periods (1987 and 1998) than in Unalaska, because of Cold Bay's smaller population base. On the whole, however, the resident population of Cold Bay in the base case declines to a low of around 150 in 1995 and then increases to, but does not substantially exceed, the 200 level.

In the absence of a RAM projection for St. George, a recent projection is used that was prepared for an economic strategies plan for the community, as shown in Appendix I, Table 3. This approximate 10-year projection is fairly optimistic in assuming that jobs can be created for existing as well as returning Aleut residents on the island. Some 25 former residents, each having one dependent, as well as 10 retired persons are anticipated to return for employment over the next decade. Between 1984 and 1995, St. George is expected to increase in resident population from 215 to 271 persons. Part-time residents are expected to vary, with construction projects making the largest contribution.

Projections Including the Lease Sale:

The population projections associated with the lease sale for Unalaska and Cold Bay (see Appendix I) include the resident population and three categories (nonproject, project, and military) of enclave population. In the case of each community, lease sale (project) enclave population is introduced in 1984 and terminated in 1999. The peak period of enclave population present in Unalaska is 1993 and 1994, whereas two peak periods are evident in Cold Bay, in 1986 and 1987 and in the years 1993 and 1994. The net differences between the base and effects cases for resident and enclave populations in Unalaska and Cold Bay are shown in Tables IV-3 and IV-4. According to these data, the net effect of the proposed lease sale on population, as an incremental addition to the base case, would be to increase resident population in Unalaska from 3 to 20 percent and in Cold Bay from 2 to 42 percent. The lease sale-associated enclave population in Unalaska would comprise not more than 5 percent of total enclave population. This would be expected to take place

Table IV-3
Rural Alaska Model Projections
St. George Basin Lease Sale (Sale 89)
Unalaska

Resident Population

| Year | Base Case | Lease Sale Case | Added By Lease Sale | Percent of Change | Percentage of Total |
|---|---|---|---|---|---|
| 1985 | 756 | 756 | 0 | 0 | 0 |
| 1990 | 974 | 999 | 25 | 2.6 | 2.5 |
| 1995 | 1,427 | 1,698 | 271 | 19.0 | 16.0 |
| 2000 | 2,235 | 2,676 | 441 | 19.7 | 16.5 |
| 2005 | 2,224 | 2,628 | 404 | 18.2 | 15.4 |
| 2010 | 2,220 | 2,560 | 340 | 15.3 | 13.3 |

Enclave Population

| Year | Base Case | Lease Sale Case | Added By Lease Sale | Percent of Change | Percentage of Total |
|---|---|---|---|---|---|
| 1985 | 322 | 322 | 0 | 0 | 0 |
| 1990 | 705 | 745 | 40 | 5.7 | 5.4 |
| 1995 | 1,555 | 1,622 | 67 | 4.3 | 4.1 |
| 2000 | 1,776 | 1,776 | 0 | 0 | 0 |
| 2005 | 1,776 | 1,776 | 0 | 0 | 0 |
| 2010 | 1,776 | 1,776 | 0 | 0 | 0 |

Alaska Native Population as Proportion of Total Resident Population

| Year | Base Case | Lease Sale Case | Difference |
|---|---|---|---|
| 1985 | 30.2 | 30.2 | 0 |
| 1990 | 26.2 | 25.5 | 0.7 |
| 1995 | 19.7 | 16.5 | 3.2 |
| 2000 | 13.9 | 11.6 | 2.3 |
| 2005 | 15.3 | 13.0 | 2.3 |
| 2010 | 16.9 | 14.7 | 2.2 |

Source: Nebesky and Knapp, 1984.

Table IV-4
Rural Alaska Model Projections
St. George Basin Lease Sale (Sale 89)
Cold Bay

**Resident Population**

| Year | Base Case | Lease Sale Case | Added By Lease Sale | Percent Of Change | Percentage of Total |
|---|---|---|---|---|---|
| 1985 | 186 | 186 | 0 | 0 | 0 |
| 1990 | 159 | 162 | 3 | 1.9 | 1.9 |
| 1995 | 156 | 323 | 167 | 107.1 | 51.7 |
| 2000 | 211 | 511 | 300 | 142.2 | 58.7 |
| 2005 | 210 | 488 | 278 | 132.4 | 57.0 |
| 2010 | 209 | 445 | 236 | 112.9 | 53.0 |

**Enclave Population**

| Year | Base Case | Lease Sale Case | Added By Lease Sale | Percent Of Change | Percentage of Total |
|---|---|---|---|---|---|
| 1985 | 76 | 76 | 0 | 0 | 0 |
| 1990 | 10 | 49 | 39 | 390.0 | ?9.6 |
| 1995 | 10 | 54 | 44 | 440.0 | 81.5 |
| 2000 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 0 | 0 | 0 | 0 | 0 |

Source: Nebesky and Knapp, 1984.

only around 1990. Project-associated enclave population would constitute a high proportion of total enclave population in Cold Bay in 1990 and 1995, but this amount of population would not be as numerically dramatic. The proportion of total resident population attributed to Alaska Natives would decline marginally in Unalaska (3% or less) as a result of the proposed sale.

In the absence of a RAM projection for St. George, the potential population effects from the lease sale can be derived from the estimates of direct employment associated with the sale, since the majority of employees of nonlocal origin are assumed to be situated on-site, generally without dependents. As shown in Appendix I, Table 6, a period of peak employment is initiated by the lease sale beginning in 1986 with 63 employees. A subsequent peak of 736 employees occurs in 1995, with long-term employment also starting in 1995. From 256 to 300 employees are associated with lease sale activities on St. George Island over the long-term life of the project.

2. Oil Spill Risk Analysis:

a. Estimated Quantity of Resource: Considerable uncertainty exists in estimating the volume of oil that may be discovered and produced as a result of an OCS lease sale. The oil resource levels used in this EIS for the oil spill-risk calculations correspond to mean-case estimates. There is, however, an important qualification in the way that resource levels are used in this EIS. The resource estimates used in predicting the number of spills expected over the life of the field, and in the oil spill risk analysis for this EIS, are based on the "unrisked" mean case estimates. This is the assumption that the resource will be discovered and produced. Obviously, if hydrocarbons are not discovered, there would be no risk of a major spill. The projected number of spills and, accordingly, the results of the oil spill-risk analysis, reflect the expected oil spill risks based on a mean resource level of 1.124 Bbbls of oil for the St. George Basin (Sale 89).

b. Probability of Oil Spills Occurring: The probability of oil spill occurrence, as used in the oil-spill-risk analysis, is based on the assumption that future spill frequencies can be based on past OCS experience. This analysis assumes that spills occur independently of each other and that the spill rate is dependent on the volume of oil produced or transported. This last assumption--spill rate is a function of the volume of oil handled--might be modified on the basis of size, extent, frequency, or duration of the handling. In the case of tanker transport, for example, the number of port calls and the number of tanker years have been considered (Stewart, 1976; Stewart and Kennedy, 1978). This analysis uses volume of oil handled, because other bases for estimates of spill frequency are necessarily derived from this quantity.

Spill Size: This analysis examines spills in two size ranges: 100,000 barrels or greater (being representative of a worst-case spill) and 1,000 barrels or greater (which-also includes 100,000-barrels or greater spills). To place these sizes in perspective to the type of accident usually involved, spills in the larger category are generally associated with catastrophes such as large blowouts or shipwrecks. Spills in the smaller category typically include these and other serious events, such as structural failures and collisions. The choice of the spill size to use depends upon the analysis to

Appendix B-3

Manpower Model

TABLE 1: EMPLOYMENT FACTORS, BY TASK, PER UNIT OF WORK (PROPOSED OCS SALE IN THE ST. GEORGE BASIN)

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **UNIT 1 - DRILLING AN EXPLORATION OR DELINEATION WELL** | | | | | | | | | | | |
| Task 1 Drilling Crew Activities | 3s | 2 | 2.9 | | 142 | 2.2 | 308 | JUN | 0 | 79.0 | 15/15 |
| Task 1-A Helicopter Support for Drilling | s | 1 | 2.8 | 1.0 | 10 | 2.2 | 22 | JUN | 0 | 47.9 | 15/15 |
| Task 1-B Supply/Anchor Boats for Drilling Support | 12 | 1 | 1.s | 2.0 | 36 | 2.2 | 79 | JUN | 0 | 58.0 | 15/15 |
| Task 1-C Longshoring Support for Drilling | 2 | 1 | 1.3 | | 3 | 2.2 | 7 | JUN | 100 | 3s.0 | 15/15 |
| Task 1-D Other Onshore Work in Support of Drilling | 6 | 1 | 1.s | | 9 | 2.2 | 2 s ' | JUN | 0 | 79.0 | 15/15 |
| **UNIT 2 - CONSTRUCTING AN EXPLORATION Whit BASE** | | | | | | | | | | | |
| Task 2 All Shore Base Construction Activities | 67 | 1 | 2.0 | | 133 | 12.6 | 1663 | JUN | 1s0 | 79.0 | 15/15 |
| **UNIT 3 - OPERATING AN EXPLORATION SHORE BASE (1 YEAR)** | | | | | | | | | | | |
| Task 3 Operating an Exploration Base for 1 Year (excluding Tasks 1-A to 1-D) | 2s | 1 | 2.0 | | 40 | 4.0 | 16s | JUN | 1s0 | 79.0 | 15/15 |
| **UNIT 4 - CONDUCTING A GEOLOGICAL-GEOPHYSICAL SURVEY** | | | | | | | | | | | |
| Task 4 All Work by Survey & Seat Crews | 15 | 1 | 2.0 | 1.0 | 32 | 5.0 | 150 | JUN | 0 | 79.0 | 15/15 |
| **UNIT 5 - CONSTRUCTING AN EXPLORATION ISLAND** | | | | | | | | | | | |
| Task 5 All Island Construction Activities | 215 | 2 | 2.0 | | 850 | 3.0 | 2580 | AUG | 100 | 70.0 | 15/15 |
| **UNIT 6 - INSTALLING A PRODUCTION PLATFORM (& EQUIP)** | | | | | | | | | | | |
| Task 6 All Work by Platform Installation Crews | 150 | 2 | 2.0 | | 600 | 8.0 | 4800 | | | | |

| (1J<br>INITS OF WORK BY TYPE, AND TASKS RELATED TO EACH TYPE OF UNIT | (2)<br>TASK CREW SIZE | (3)<br>SHIFT FACTOR | (4)<br>ROTATION FACTOR | (5)<br>NUMBER OF AIRCRAFT O R BOATS PER UNIT | (6)<br>TOTAL TASK WORKFORCE PER UNIT | [7]<br>DURATION OF TASK (MONTHS) | (B)<br>TOTAL MAN-MONTHS PER TASK PER UNIT | (9)<br>PROBABLE STARTING MONTH OF TASK | (10)<br>PERCENT OF LOW SKILLED JOSS | (11)<br>PERCENT OF OUT-OF-STATE COMMUTERS | (12)<br>ROTATION PATTERN: DAYS ON/ DAYS OFF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **UNIT 1- DRILLING AN EXPLORATION OR DELINEATION WELL** | | | | | | | | | | | |
| Task 1 Drilling Crew Activities | 35 | 2 | 2.8 | | 140 | 2.2 | 30s | JUN | o | 79.0 | 15/15 |
| Task HI Helicopter Support for Drilling | 5 | 1 | 2.0 | 1.0 | 10 | 2.2 | 22 | JUN | 0 | 47.S | 15/15 |
| Task 1-S Supply/Anchor Boats for Drilling Support | 12 | i | 1.5 | 2.0 | 36 | 2.2 | 79 | JUN | O | 58.0 | 15/15 |
| Task 1-C Longshoring Support for Drilling | 2 | 1 | 1.5 | | 3 | 2.2 | 7 | JUN | 100 | 35.0 | 15/15 |
| Task 1-0 Other Onshore Work in Support of Drilling | 6 | 1 | 1.5 | | 9 | 2.2 | 2s | JUN | 0 | 19.0 | 15/15 |
| **UNIT 2- CONSTRUCTING AN EXPLORATION SHORE BASE** | | | | | | | | | | | |
| Task 2 All Shore Base Construction Activities | 67 | 1 | 2.0 | - | 133 | 12.0 | 1600 | JUN | 1s2 | 79.0 | 15/15 |
| **UNIT 3- OPERATING AN EXPLORATION SHORE BASE (1 YEAR)** | | | | | | | | | | | |
| Task 3 Operating an Exploration Base for 1 Year (excluding Tasks 1-A to 1-D) | 20 | 1 | 2.0 | | 4a | 4.0 | 160 | JUN | 120 | 79. e | 15/15 |
| **IHIT 4- CONDUCTING A GEOLOGICAL-GEOPHYSICAL SURVEY** | | | | | | | | | | | |
| Task 4 All Work by Survey & SOat Crews | 1s | 1 | 2.0 | Lo | 30 | s.0 | 150 | JUN | 0 | 79.9 | 15/15 |
| **UNIT 5 - CONSTRUCTING AN EXPLORATION ISLAND** | | | | | | | | | | | |
| Taak 5 All Island Construction Activities | 215 | 2 | 2.0 | | 06S | 3.0 | 2sss | AUG | 100 | 70.0 | 15/15 |
| **UNIT 6- INSTALLING A PRODUCTION PLATFORM (& EQUIP)** | | | | | | | | | | | |
| Task 6 All Work by Platform Installation Crews | 150 | 2 | 2.0 | | 6ss | 8.0 | 4S244 | JUN | o | 89.5 | 15/15 |
| Taak 6-R Helicopter Support-platform Installation | 5 | 1 | 2.0 | 1.0 | 10 | 8.0 | 80 | JUN | o | 47. 5 | 15/15 |
| Task 6-S Tugboat Support for Platform Installation | 10 | 1 | 1.5 | 4.@ | 6S | 1.0 | 60 | Jut | o | 58.0 | 15/15 |
| Taak 6-C Supply/Anchor Soat Support-Platform Inst. | 13 | 1 | 1.5 | 3.0 | 59 | 8.0 | 46S | JUN | 0 | 5s.0 | 15/15 |
| Taak 6-0 Longshoring for Platform Installation | 2s | 1 | 1.5 | - | 3a | 8.0 | 240 | JUN | 100 | 35.0 | 15/15 |
| Task 6-? Other Onshore Support for Platform Inst. | 25 | 1 | 1.5 | | 3S | 8.0 | 3S9 | JUN | 0 | 89.5 | 15/15 |

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TABLE 1: EMPLOYMENT FACTORS, BY TASK, PER UNIT OF WORK (PROPOSED OCS SALE IN THE ST. GEORGE BASIN)

| (1) UNITS OF WORK BY TYPE, AND TASKS RELATED TO EACH TYPE OF UNIT | (2) TASK CREW SIZE | (3) SHIFT FACTOR | (4) ROTATION FACTOR | (5) NUMBER OF AIRCRAFT OR BOATS PER UNIT | (6) TOTAL TASK WORKFORCE PER UNIT | (7) DURATION OF TASK (MONTHS) | (8) TOTAL MAN-MONTHS PER TASK PER UNIT | (9) PROBABLE STARTING MONTH OF TASK | (10) PERCENT OF LOW SKILLED JOBS | (11) PERCENT OF OUT-OF-STATE COMMUTERS | (12) ROTATION PATTERN: DAYS ON/ DAYS OFF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **UNIT 7 - INSTALLING AN OFFSHORE LOADING PLATFORM** | | | | | | | | | | | |
| Task 7 All Work by Platform Installation Crews | 40 | 2 | 2.0 | - | 160 | 2.5 | 400 | JUN | 0 | 89.5 | 15/15 |
| Task 7-A Helicopter Support-Platform Installation | 5 | 1 | 2.0 | 1.0 | 10 | 2.5 | 25 | JUN | 0 | 47.5 | 15/15 |
| Task 7-B Tugboat Support for Platform Installation | 12 | 1 | 2.0 | 1.0 | 24 | 1.0 | 24 | JUN | 0 | 58.0 | 15/.5 |
| Task 7-C Supply/Anchor Boat Support-Platform Inst. | 12 | 1 | 2.0 | 1.0 | 24 | 2.5 | 60 | JUN | 0 | 58.0 | 15/.5 |
| Task 7-D Longshoring for Platform Installation | 6 | 1 | 2.0 | - | 12 | 2.5 | 30 | JUN | 100 | 35.0 | 15/.5 |
| Task 7-E Other Onshore Support for Platform Inst. | 8 | 1 | 2.0 | - | 16 | 2.5 | 40 | JUN | 0 | 89.5 | 15/.5 |
| **UNIT 8 - CONSTRUCTING A PRODUCTION SHORE BASE** | | | | | | | | | | | |
| Task 8 All Shore Base Construction Activities | 200 | 1 | 2.0 | - | 400 | 12.0 | 4800 | JUN | 100 | 47.5 | 15/15 |
| **UNIT 9 - DRILLING A PRODUCTION OR SERVICE WELL** | | | | | | | | | | | |
| Task 9 All Work of the Drilling Crews | 28 | 2 | 2.0 | - | 112 | 1.7 | 187 | JUN | 0 | 79.0 | 15/15 |
| **UNIT 10 - LAYING OFFSHORE OIL PIPE (100 MILES)** | | | | | | | | | | | |
| Task 10 All Work of the Laying Barge Crews | 125 | 2 | 2.0 | 1.0 | 500 | 4.2 | 2085 | JUN | 0 | 89.5 | 15/15 |
| Task 10-A Helicopter Support for Pipe Laying | 5 | 1 | 2.0 | 1.0 | 10 | 4.2 | 42 | JUN | 0 | 47.5 | 15/15 |
| Task 10-B Tugboat Support for Pipe Laying | 10 | 1 | 1.5 | 2.0 | 30 | 4.2 | 125 | JUN | 0 | 58.0 | 15/15 |
| Task 10-C Supply/Anchor Boats for Pipe Laying | 13 | 1 | 1.5 | 3.0 | 59 | 4.2 | 244 | JUN | 0 | 58.0 | 15/15 |
| Task 10-D Longshoring Support for Pipe Laying | 20 | 1 | 1.5 | - | 30 | 4.2 | 125 | JUN | 100 | 35.0 | 15/15 |
| Task 10-E Other Onshore Support for Pipe Laying | 35 | 1 | 1.5 | - | 53 | 4.2 | 219 | JUN | 0 | 89.5 | 15/15 |
| **UNIT 11 - LAYING ONSHORE OIL PIPE (100 MILES)** | | | | | | | | | | | |
| Task 11 All Pipeline Laying & Related Activities | 350 | 1 | 2.0 | - | 700 | 6.7 | 4667 | JUN | 60 | 79.0 | 15/15 |
| **UNIT 12 - CONSTRUCTING A MARINE OIL TERMINAL** | | | | | | | | | | | |
| Task 12 All Related Activities | 300 | | 2.0 | - | 600 | 12.0 | 7200 | JUN | 80 | 47.5 | 15/15 |

TABLE 1: EMPLOYMENT FACTORS, BY TASK, PER UNIT OF WORK (PROPOSED OCS SALE IN THE ST. GEORGE BASIN)

| (1) UNITS OF WORK BY TYPE, AND TASKS RELATED TO EACH TYPE OF UNIT | (2) TASK CREW SIZE | (3) SHIFT FACTOR | (4) ROTATION FACTOR | (5) NUMBER OF AIRCRAFT OR BOATS PER UNIT | (6) TOTAL TASK WORKFORCE PER UNIT | (7) DURATION OF TASK (MONTHS) | (8) TOTAL MAN-MONTHS PER TASK PER UNIT | (9) PROBABLE STARTING MONTH OF TASK | (10) PERCENT OF LOW SKILLED JOBS | (11) PERCENT OF OUT-OF-STATE COMMUTERS | (12) ROTATION PATTERN: DAYS ON/ DAYS OFF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **UNIT 13- CONSTRUCTING AN ONSHORE PUMP STATION** | | | | | | | | | | | |
| Task 13 All Related Activities | 100 | 1 | 2.0 | | 200 | &o | 1600 | JUN | 80 | 47.5 | 15/15 |
| **UNIT 14 - CONSTRUCTING A PRODUCTION ISLAND** | | | | | | | | | | | |
| Task 14 All Related Activities | 225 | 2 | 2.0 | | 900 | 3.0 | 2700 | AUG | 80 | 47.5 | 15/15 |
| **UNIT 15 - OPERATING A PRODUCTION PLATFORM (1 YEAR)** | | | | | | | | | | | |
| Task 15 All Work of Platform Operations Crews | 45 | 2 | 2.0 | | 180 | 12.0 | 2160 | VARIES | 10 | 25.0 | 15/15 |
| Task 15-A Helicopter Support-Platform Operations | 5 | 1 | 2.0 | 1.0 | 10 | 12.0 | 120 | " | 0 | 25.0 | 15/15 |
| Task 15-B Supply/Anchor Boats-Platform Operations | 12 | 1 | 1.5 | 1.0 | 18 | 12.0 | 216 | " | 0 | 25.0 | 15/15 |
| Task 15-C Longshoring for Platform Operations | 6 | 1 | 1.5 | | 9 | 12.0 | 108 | " | 100 | 25.0 | 15/15 |
| Task 15-D Other Onshore Work for Platform Operatns | 2 | 1 | 1.5 | | 3 | 12.0 | 36 | " | 0 | 25.0 | 15/15 |
| **UNIT 16- PERFORMING A MAJOR PLATFORM MAINTENANCE** | | | | | | | | | | | |
| Task 16 All Work of Platform Maintenance Crews | 10 | 1 | 2.0 | | [illegible] | 4.0 | 80 | JUN | 0 | 25.0 | 15/15 |
| **UNIT 17- PERFORMING A PRODUCTION ISLAND MAINTENANCE** | | | | | | | | | | | |
| Task 17 All Work of Island Maintenance Crews | 28 | 2 | 2.0 | | 112 | 3.9 | 336 | AUG | 100 | 25.0 | 15/15 |
| **UNIT 18 - WELL WORKOVERS FOR 1 OIL PLATFORM** | | | | | | | | | | | |
| Task 18 All Work of Workover Crews | 10 | 1 | 2.0 | | 2s | 6.0 | 120 | JUN | 0 | 29.0 | 15/15 |



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TABLE 2: NUMBER OF UNITS PER YEAR BY TYPE, AND RESULTING TOTAL EMPLOYMENT BY TASK (DUE TO PROPOSED SALE IN THE ST. GEORGE BASIN)

| | 1905 | 1926 | 1987 | 1988 | 1909 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UNIT 1 - NO. OF EXPLORATION & DELINEATION WELLS DRILLED | 0 | 1 | 3 | 4 | 3 | 5 | 6 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL RESULTING EMPLOYMENT, BY TRW (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 1 Drilling Crew Activities | 0 | 308 | 924 | 1232 | 924 | 1540 | 1240 | 1232 | 308 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 1-A Helicopter Support for Drilling | 0 | 22 | 66 | 88 | 66 | 110 | 132 | 88 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 1-B Supply/Anchor Boats for Drilling Support | 0 | 79 | 23s | 317 | 230 | 3% | 475 | 317 | 79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 1-C Longshoring Support for Drilling | 0 | 7 | 20 | 26 | 20 | 33 | 40 | 26 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 1-0 Other Onshore kbrk in Support of Drilling | 0 | 20 | 59 | 79 | 59 | 99 | 119 | 19 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| UNIT 2- NO. OF EXPLORATION SHORE BASES CONSTRUCTED | ~~0.50~~ | a.50 | 0.00 | 0.00 | 0.00 | 0.w | 0.w | 0.00 | 0.00 | | | | | | | | | |
| TOTAL RESULTING EMPLOYMENT, BY TASK tINWHONTN211 | | | | | | | | | | | | | | | | | | |
| Task 2 All Shore Base Construction Activities | ~~800~~ | 800 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | o | 0 | 0 | 0 | 0 | 0 |
| UNIT 3- NO. OF EXPLORATION SHORE BASES OPERATING | 0.00 | 1.00 | 1.20 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.w | 0.00 | 0.00 | 0.00 | 9.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 3 All Base Operations (Xcpt Tasks 1-A to 1-D) | 0 | 160 | 160 | 160 | 16a | 160 | 160 | 1613 | 160 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| UNIT 4 - NO. OF GEOPHYSICAL-GEOLOG. SURVEYS CONDUCTED | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 4 All Work by Survey & Boat Crews | 0 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| UNIT 5- NO. OF EXPLORATION ISLANDS CONSTRUCTED | 0.00 | 0.W | o.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.w | a.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 5 All Island Construction Activities | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| UNIT 6- NO. OF PRODUCTION PLATFORMS (& EO) INSTALLED | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 | 2.000 | 3.000 | 3.000 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 6 All Work by Platform Installation Crews | 0 | 0 | 0 | 0 | 0 | 4800 | 9600 | 14400 | 14400 | 4800 | 4s00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 6-A Helicopter Support - Platform Installation | 0 | 0 | 0 | 0 | 0 | 80 | 160 | 240 | 240 | 80 | 80 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 6-B Tugboat Support for Platform Installation | 0 | 0 | 9 | 0 | 0 | 60 | 120 | 120 | 180 | 60 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Taak 6-C Supply/Anchor Boat Support-Platfom Inst. | 0 | 0 | 0 | 0 | 0 | 468 | 936 | 1404 | 1404 | 460 | 468 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 6-O Longshoring for Platform Installation | 0 | 0 | 0 | 0 | 0 | 240 | 480 | 720 | 720 | 240 | 248 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Taak 6-E Other Onshore SupPork for Platform Inst. | 0 | 0 | 0 | 0 | 0 | 322 | 600 | 900 | 900 | 300 | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

TABLE 2: NUMBER OF UNITS PER YEAR BY TYPE, AND RESULTING TOTAL EMPLOYMENT BY TASK (DUE TO PROPOSED SALE IN THE 97. GEORGE BASIN)

| | 1985 | 1986 | 1927 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1296 | 1997 | 1992 | 1999 | 2000 | 2005 | 2219 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UNIT 7- NO. OF OFFSHORE LOADING PLATFORMS INSTALLED | 0.000 | 0.030 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.250 | 1.250 | 0.000 | 0.000 | | | | | | |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 7 All Work by Platform Installation Crews | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 500 | 500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 7-A Helicopter Support - Platform Installation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 7-B Tugboat Support for Platform Installation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 7-C Supply/Anchor 2oat Support-Pi at form Inst. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 75 | 75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 7-D Longshoring for Platform Installation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 7-2 Other Onshore Support for Plat fom Inst. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| UNIT 8 - NO. OF PRUOIJH1ON SHORE BASES CONSTRUCTED | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0. 00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| TOTAL RESULTING EMPLOYMENT, BY TASK I IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 8 All Shore Base Construction Activities | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4800 | 4800 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| UNIT 9- NO. OF PRODUCTION OR SERVICE WELLS DRILLED | 0 | 0 | 0 | 0 | 0 | 4 | 12 | 30 | 2a | 22 | 8 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 9 All Work of the Drilling Crews | 0 | 0 | 0 | 0 | 0 | 747 | 2240 | 5601 | 5228 | 4107 | 1494 | 747 | 0 | 0 | 0 | 0 | 0 | 0 |
| UNIT 10 - OFFSHORE OIL PIPE (100'S IF MILES LAYED) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0. n | 0.75 | 2.00 | 2.2a | 0.00 | 0.00 | 0.00 | 0.00 | 0. w | 0. w |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 113 All Work of the Laying Barge Crews | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1564 | 1564 | 4170 | 41700 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 10-A Helicopter Support for Pipe Laying | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 31 | 83 | 23 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 10-B Tugboat Supped for Pipe Laying | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 94 | 94 | 250 | 2s2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 19-C Supply/Anchor Boats for Pips Laying | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 183 | 183 | 429 | 488 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 10-D Longshoring Support for Pipe Laying | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 94 | 94 | 252 | 252 | 0 | 0 | 0 | 0 | a | 0 |
| Task 10-E Other Onshore Support for Pips Laying | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 164 | 164 | 438 | 432 | 0 | 0 | 0 | 0 | 0 | 0 |
| UNIT 11- ONSHORE OIL PIPE (100'S OF ITILES LAYED) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.400 | | | | | | |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 11 All Pipeline Laying & Related Activities | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1267 | 0 | 0 | 0 | 0 | 0 | 0 |
| UNIT 12 - NO. OF MARINE OIL TERMINALS CONSTRUCTED | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 8.22 | 1.00 | 2.00 | 2.00 | 0.00 | | | | | |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 12 All Related Activities | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | e | 72W | 14400 | 14400 | 0 | 0 | 0 | 0 | 0 | |
| UNIT 13- NO. ONSHORE PUMP STATIONS CONSTRUCTD (GAS&OIL) | 0.00 | 0.00 | 0.00 | 9.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0. w | | | 1. w | | | | | | |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 13 All Related Activities | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1600 | 0 | 0 | 0 | 0 | 0 | |

TABLE 2: NUMBER Of UNITS PER YEAR BY TYPE, AND RESULTING TOTAL EMPLOYMENT BY TASK (DUE TO PROPOSED SALE IN THE ST. GEORGE BASIN)

| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1990 | 1999 | m | 2005 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UNIT 14 - NO. OF PRODUCTION ISLANDS CONSTRUCTED | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | | | | | | | | |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 14 All Related Activities | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| UNIT 15- NO. OF PRODUCTION PLATFORMS OPERATING | 0.m | 0.00 | 0.00 | 9.W | 0.00 | 0.00 | 0.W | 0.00 | 0.00 | 0.00 | 5.00 | 5.00 | 11.00 | 11.00 | 11.00 | 11.00 | 10.00 | 8.00 |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Taak 15 All Work of Platform Operations Crews | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10800 | 10800 | 23760 | 23766 | 2376S | 23760 | 21600 | 17280 |
| Task 15-A Helicopter Support-Platform Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 600 | 662 | 1320 | 1320 | 1326 | 1320 | 1200 | 960 |
| Task 15-B Supply/Anchor Boats-Platform Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1080 | 1080 | 2376 | 2376 | 2376 | 2376 | 2162 | |
| Task 15-C Longshoring for Platform Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 540 | 540 | 1188 | 1188 | 11SS | 1188 | 1080 | 264 |
| Task 15-D Other Onshore Work for Platform Operations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 180 | 180 | 396 | 3% | 396 | 396 | 360 | 288 |
| UNIT 16 -ML PLATFORM MAINTENANCES PERFORMED (ANNUAL) | 0.00 | 0.00 | 0.00 | 8.W | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | 5.S0 | 11.20 | 11.00 | 11.00 |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 16 All Work of Platform Maintenance Crews | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 400 | 400 | 880 | 880 | 880 |
| UNIT 17- NO. OF PRODUCTION ISLAND MAINTENANCES | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | a |
| TOTAL RESULTING EMPLOYMENT, ST TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 17 All Nork of Island Maintenance Crews | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| ONIT 18 - NO. OIL PLATFORMS HAVING WELLS WORKED OVER | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | s | 5 | 5 |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 18 Till Work of Workover Crews | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 600 | 600 | |
| UNIT 19 - NO. OF PRODUCTION SHORE BASES OPERATING | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 1.25 | 1.25 | 1.25 | 1.25 | 1.2s | 1.25 |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 19 All Saaa Operations (excluding tasks related to Units 6,7,10 & 15) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1200 | 1200 | 500 | 500 | 15s2 | 500 | 500 | 1500 |
| UNIT 2S - NO. OF MARINE OIL TERMINALS OPERATED | e.00 | 0.00 | 0.00 | 0.W | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 | 3. 0 | 3.00 | 3.00 | 3.00 | 3.26 | 3.00 |
| TOTAL RESULTING EMPLOYMENT, BY TASK (IN MAN-MONTHS): | | | | | | | | | | | | | | | | | | |
| Task 20 All Terminal Operations Activities | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1680 | 162s | 5246 | 5040 | 5040 | 5040 | 5040 | 5040 |
| HEADQUARTERS EMPLOYMENT (Annual Overages) | 0 | 10 | 10 | 14 | 20 | 24 | 36 | 40 | 50 | 60 | 60 | 66 | 66 | 60 | 60 | 60 | 50 | 40 |
| TOTAL EMPLOYMENT FOR ALL TASKS (Annual Averages) | 67 | 139 | 145 | 1ss | 155 | 789 | 1452 | 2165 | 2673 | 2136 | 3693 | 3424 | 3025 | 30s2 | 3%SS | 314S | | 2462 |

TABLE 4: SKILLED & UNSKILLED JOB TOTALS (WITHIN INDUSTRY, ONSHORE/OFFSHORE, AND SHORT-TERM/LONG-TERM CATEGORIES)

| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALL PETROLEUM RELATED EMPLOYMENT (OCS SALE 999) .... | 67 | 139 | 145 | 185 | 155 | 789 | 1452 | 2165 | 2673 | 2136 | 3693 | 3424 | 3025 | 3058 | 3058 | 3148 | 2918 | 2468 |
| PETROLEUM HEADQUARTERS EMPLOYMENT (Anchorage) ....... | 0 | 10 | 0 | 14 | 20 | 24 | 30 | 40 | 50 | 60 | 60 | 60 | 60 | 60 | 60 | | 50 | 40 |
| PETROLEUM MINING - TOTAL EXCEPT HEADQUARTERS JOBS (These totals include the figures for Task 20 and for one-third of Task 19, which are shown separately at the bottom of this table.) | 0 | 53 | 108 | 135 | 108 | 650 | 1226 | 1877 | 1954 | 957 | 2088 | 1601 | 2558 | 2591 | 2591 | 2681 | 2498 | 2132 |
| ONSHORE JOBS | | | | | | | | | | | | | | | | | | |
| SHORT-TERM | | | | | | | | | | | | | | | | | | |
| Skilled .................................. | 0 | 2 | 5 | 7 | 5 | 33 | 60 | 82 | 94 | 43 | 61 | 36 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unskilled .................................. | 0 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LONG-TERM | | | | | | | | | | | | | | | | | | |
| Skilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 15 | 33 | 33 | 33 | 33 | 30 | 24 |
| Unskilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 67 | 67 | 83 | 83 | 83 | 83 | 83 | 83 |
| OFFSHORE JOBS | | | | | | | | | | | | | | | | | | |
| SHORT-TERM | | | | | | | | | | | | | | | | | | |
| Skilled .................................. | 0 | 38 | 90 | 115 | 90 | 683 | 1153 | 1782 | 1846 | 914 | 872 | 410 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unskilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LONG-TERM | | | | | | | | | | | | | | | | | | |
| Skilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 810 | 810 | 1782 | 1815 | 1815 | 1985 | 1743 | 1419 |
| Unskilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 90 | 90 | 198 | 198 | 198 | 198 | 180 | 144 |
| PETROLEUM CONSTRUCTION - TOTAL JOBS (These totals include the figures for Task 12 which are shown separately at the bottom of this table) | 67 | 67 | 0 | 0 | 0 | 0 | 0 | 0 | 400 | 1000 | 1200 | 1489 | 0 | 0 | 0 | 0 | 0 | 0 |
| ONSHORE JOBS | | | | | | | | | | | | | | | | | | |
| SHORT-TERM | | | | | | | | | | | | | | | | | | |
| Skilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unskilled .................................. | 67 | 67 | 0 | 0 | 0 | 0 | 0 | 0 | 400 | 400 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LONG-TERM | | | | | | | | | | | | | | | | | | |
| Skilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unskilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| OFFSHORE JOBS | | | | | | | | | | | | | | | | | | |
| SHORT-TERM | | | | | | | | | | | | | | | | | | |
| Skilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unskilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LONG-TERM | | | | | | | | | | | | | | | | | | |
| Skilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| Unskilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| TROLEUM TRANSPORTATION - TOTAL AIR TRANSP. JOBS | 0 | 2 | 6 | 7 | 6 | 16 | 24 | 27 | 27 | 12 | 64 | 57 | 110 | 110 | 110 | 110 | 100 | 80 |
| ONSHORE JOBS | | | | | | | | | | | | | | | | | | |
| SHORT-TERM | | | | | | | | | | | | | | | | | | |
| Skilled .................................. | 0 | 2 | 6 | 7 | 6 | 16 | 24 | 27 | 27 | 12 | 14 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unskilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LONG-TERM | | | | | | | | | | | | | | | | | | |
| Skilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 50 | 110 | 110 | 110 | 110 | 100 | 80 |
| Unskilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| OFFSHORE JOBS | | | | | | | | | | | | | | | | | | |
| SHORT-TERM | | | | | | | | | | | | | | | | | | |
| Skilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unskilled .................................. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

TABLE 4: SKILLED & UNSKILLED JOB TOTALS (WITHIN INDUSTRY, ONSHORE/OFFSHORE, AND SHORT-TERM/LONG-TERM CATEGORIES)

| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LONG-TERM | | | | | | | | | | | | | | | | | | |
| Skilled ................................ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unskilled ................................ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PETROLEUM TRANSPORTATION - TOTAL MARINE TRANSP. JOBS | 0 | 7 | 21 | 29 | 21 | 100 | 171 | 221 | 242 | 107 | 281 | 217 | 297 | 297 | 297 | 297 | 270 | 216 |
| ONSHORE JOBS | | | | | | | | | | | | | | | | | | |
| SHORT-TERM | | | | | | | | | | | | | | | | | | |
| Skilled ................................ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unskilled ................................ | 0 | 1 | 2 | 2 | 2 | 23 | 43 | 62 | 71 | 31 | 41 | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| LONG-TERM | | | | | | | | | | | | | | | | | | |
| Skilled ................................ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unskilled ................................ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 45 | 99 | 99 | 99 | 99 | 90 | 72 |
| OFFSHORE JOBS | | | | | | | | | | | | | | | | | | |
| SHORT-TERM | | | | | | | | | | | | | | | | | | |
| Skilled ................................ | 0 | 7 | 20 | 26 | 20 | 77 | 128 | 158 | 170 | 76 | 106 | 62 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unskilled ................................ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LONG-TERM | | | | | | | | | | | | | | | | | | |
| Skilled ................................ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 90 | 90 | 198 | 198 | 198 | 198 | 180 | 144 |
| Unskilled ................................ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 12 - Const Oil Terminal/LNG Plant (Skilled) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 120 | 240 | 240 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 12 - Const Oil Terminal/LNG Plant (Unskilled) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 480 | 960 | 960 | 0 | 0 | 0 | 0 | 0 | 0 |
| One-Third of Task 19 - Operating a Shore Base ....... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 33 | 42 | 42 | 42 | 42 | 42 | 42 |
| Task 20 - Operating an Oil Terminal & LNG Plant ..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 140 | 140 | 420 | 420 | 420 | 420 | 420 | 420 |
| Task 11 - Laying Onshore Pipe (Skilled Manpower) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 11 - Laying Onshore Pipe (Unskilled Manpower) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 93 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 13 - Constructing Onshore Pump Station (Skilled) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 0 |
| Task 13 - Constructing Onshore Pump Stn Uns | | | 0 | 0 | 0 | | 0 | | | 0 | 0 | 107 | 0 | 0 | 0 | | 0 | 0 |

TRUE 5: PROJECTED OCS EMPLOYMENT AFFECTING THE COMMUNITY OF UNALASKA (DUTCH HARBOR)

| | 1985 | 1986 | 1987 | 1902 | 1989 | 1990 | | 992 | | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2205 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOW. ONSHORE JOBS IN OR NEAR THIS COMMUNITY (Including Jobs Held by Transient Workers Who Rotate to Permanent Residences in Other Communities) | 33 | 41 | 11 | 12 | 11 | 46 | 80 | 110 | 325 | 252 | 157 | 123 | 157 | 157 | 157 | 157 | 147 | 126 |
| SHORT-TERM JOBS | | | | | | | | | | | | | | | | | | |
| Skilled | 0 | 1 | 2 | 3 | 2 | 17 | 30 | 41 | 47 | 21 | 31 | 18 | e | 0 | 0 | 0 | 0 | 0 |
| unskilled | 33 | 41 | 8 | 9 | 8 | 29 | 50 | 69 | 278 | 231 | 41 | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| LONG-TERM JOBS | | | | | | | | | | | | | | | | | | |
| Skilled | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 17 | 17 | 17 | 17 | 15 | 12 |
| Unskilled | 0 | 0 | 0 | 0 | 0 | 0 | 0 | e | 0 | 0 | 78 | 70 | 141 | 141 | 141 | 141 | 132 | 114 |
| 10TRL JOOS OFFSHORE FROM THIS COMMUNITY | 0 | 7 | 20 | 26 | 20 | 77 | 128 | 158 | 170 | 76 | 1% | 152 | 198 | 192 | 198 | 198 | 122 | 144 |
| SHORT-TERM JOBS | | | | | | | | | | | | | | | | | | |
| Skilled | 0 | 7 | 20 | 26 | 20 | 77 | 128 | 152 | 170 | 76 | 106 | 62 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unskilled | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LONG-TERM JOB? | | | | | | | | | | | | | | | | | | |
| Skilled | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 90 | 90 | 198 | 198 | 198 | 198 | 188 | 144 |
| Unskilled | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Appendix B-4

RAM **Model**

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Revised RAM Model Projections for
OCS Sale 89
Unalaska

Prepared by

Will Nebesky and Gunnar Knapp
Institute of Social and Economic Research
University of Alaska

October 19, 1984

B

Note: The following tables present revised RAM Model projections for the impacts of OCS Sale 89 on the community of Unalaska, based on new direct OCS employment OCS assumptions provided by the Minerals Management Service Alaska OCS office. All other assumptions are identical to those described in Social and Economic Studies Program Technical Report Number 87, St. George Basin and Norton Aleutian Basin Economic and Demographic Systems Impacts Analysis (June 1984).

List of Tables

List of Tables for Appendixes A and O

| Table Number | Variables in Table |
|---|---|
| 1 | Resident Population, Nonproject Enclave Population, Project Enclave Population, Military Enclave Population, Total Population Including Enclaves and Military |
| 2 | Resident Population, Native Population, Non-Native Population, Native Male Population, Native Female Population, ./ion-Native Male Population, Non-Native Female Population |
| 3 | Resident Population, Preschool Age, School Age, Adult, Senior |
| 4 | Resident Population, Change in Resident Population, Natural Increase, Net Migration, Net Migration of Workers, Net Migration of Dependents |
| 5 | Resident Employment, Nonproject Enclave Employment, Project Enclave Employment, Military Enclave Employment, Total Employment Including Enclaves and Military |
| 6 | Total Resident Employment, Resident Basic Employment, Resident Support Employment, Resident Government Employment, Resident Project Employment |
| 7" | Total Resident Employment, Resident Fishing Employment, Resident Fish Processing Employment, Other Resident Basic Employment |
| 8 | Total Resident Support Employment, Endogenous Resident Support Employment, Government Sponsored Resident Support Employment, Exogenous Resident Support Employment, Enclave Sponsored Resident Support Employment |
| 9 | Total Civilian Government Employment, Endogenous Civilian Government Employment, Exogenous Civilian Government Employment |
| 10 | Onshore Short-term Skilled Project Employment, Onshore Short-term Nonskilled Project Employment, Onshore Long-term Skilled Project Employment, Onshore Long-term Nonskilled Project Employment, Total Onshore Project Employment |

## TABLE 1. EMPLOYMENT AT UNALASKA, 1981-2010, WITH AND WITHOUT THE PROPOSED LEASE OFFERING

| | Projected Employment Without the Lease Offering | | | Estimated Employment Effects of the Proposed Lease Offering | | |
|---|---|---|---|---|---|---|
| Year | Resident Employment | Enclave Employment | Total Employment | Resident Employment | Enclave Employment | Total Employment |
| 1981 | 368 | 609 | 977 | 0 | 0 | 0 |
| 1982 | 352 | 233 | 58s | 0 | 0 | 0 |
| 1983 | 341 | 166 | 507 | 0 | 0 | 0 |
| 1984. | 426 | 30s | 731 | 0 | 0 | 0 |
| 1985 | 401 | 322 | 724 | 18 | 25 | 43 |
| 1986 | 419 | 389 | 808 | 21 | 33 | 54 |
| 1987 | 486 | S76 | 1062 | 4 | 8 | 12 |
| 1988 | 476 | 525 | 1000 | 5 | 10 | 15 |
| 1989 | 487 | 596 | 1083 | 4 | 8 | 13 |
| 1990 | 524 | 705 | 1229 | 16. | 40 | 56 |
| 1991 | 593 | 864 | 1457 | 2s | 71 | 96 |
| 1992 | 621 | 1019 | 1640 | 33 | 97 | 130 |
| 1993 | 671 | 1173 | 1844 | 94 | 288 | 382 |
| 1994 | 724 | 1326 | 2050 | $1 | 218 | 299 |
| 1995 | 793 | 1555 | 2347 | 169 | 67 | 236 |
| 1996 | 885 | 1735 | 2619 | 159 | 37 | 1% |
| 1997 | 1025 | 1929 | 29s4 | 273 | 3 | 276 |
| 1998 | 1133 | 1939 | 3071 | 274 | 1 | 275 |
| 1999 | 1371 | 1842 | 3153 | 275 | 0 | 276 |
| 2000 | 1284 | 1776 | 3060 | 27S | 0 | 275 |
| 2001 | 1279 | 1776 | 3055 | 2?4 | 0 | 274 |
| 2002 | 1274 | 1776 | 30s0 | 273 | 0 | 273 |
| 2003 | 1270 | 1776 | 3046 | 2?2 | -0 | 272 |
| 2004 | 1266 | 1776 | 3042 | 271 | 0 | 271 |
| 2005 | 1262 | 1776 | 3038 | 252 | 0 | 252 |
| 2006 | 1259 | 1776 | 3035 | 250 | 0 | 250 |
| 2007 | 1255 | 1776 | 3031 | 250 | 0 | 250 |
| 2008 | 1252 | 1776 | 3028 | 249 | -0 | 249 |
| 2009 | 1248 | 1776 | 3024 | 248 | 0 | 248 |
| 2010 | 1245 | 1776 | 3021 | 212 | -0 | 212 |

TA8LE 2. POPULATION AT UNALASKA, 1981-2010, wITH AND WITHOUT THE PROPOSED LEASE OFFERING

| | Projected Population Without the Lease Offering | | | Estimated Population Effects of the Proposed Lease Offering | | |
|---|---|---|---|---|---|---|
| Year | Resident Population | Enclave Population | Total Population | Resident Population | Enclave Population | Total Population |
| 1981 | 687 | 609 | 1296 | 0 | 0 | 0 |
| 1982 | 665 | 233 | 898 | 0 | 0 | 0 |
| 1983 | 652 | 166 | 818 | 0 | 0 | 0 |
| 1984 | 791 | 305 | 1097 | 0 | 0 | 0 |
| 1985 | 756 | 322 | 1079 | 29 | 25 | 54 |
| 1986 | 788 | 389 | 1177 | 34 | 33 | 67 |
| 1987 | 901 | 576 | 1477 | 6 | 8 | 14 |
| 1933 | 888 | 525 | 1413 | 8 | 10 | 18 |
| 1989 | 910 | 596 | 1506 | 7 | 8 | 15 |
| 1990 | 974 | 705 | 1679 | 25 | 40 | 65 |
| 1991 | 1089 | 864 | 1953 | 40 | 71 | 111 |
| 1992 | 1139 | 1019 | 2158 | 52 | 97 | 149 |
| 1993 | 1223 | 1173 | 23% | 151 | 288 | 439 |
| 1994 | 1313 | 1326 | 2639 | 129 | 218 | 347 |
| 1995 | 1427 | 1555 | 2982 | 271 | 67 | 338 |
| 1996 | 1579 | 1735 | 3314 | 2S5 | 37 | 291 |
| 1997 | 1808 | 1929 | 3737 | 438 | 3 | 441 |
| 1998 | 1985 | 1939 | 3924 | 439 | 1 | 440 |
| 1999 | 2275 | 1842 | 4117 | 441 | 0 | 441 |
| 2000 | 2235 | 1776 | 4011 | 441 | 0 | 441 |
| 2001 | 2233 | 1776 | 4009 | 439 | 0 | 439 |
| 2002 | 2229 | 1776 | 4005 | 43.7 | 0 | 437 |
| 2003 | 2227 | 1776 | 4003 | 435 | -0 | 435 |
| 2004 | 2226 | 1776 | 4002 | 434 | 0 | 434 |
| 2005 | 2224 | 1776 | 4000 | 403 | 0 | 403 |
| 2006 | 2223 | 1776 | 3999 | 401 | 0 | 401 |
| 2007 | 2222 | 1776 | 3998 | 400 | 0 | 400 |
| 2008 | 2221 | 1776 | 3997 | 399 | -0 | 399 |
| 2009 | 2221 | 1776 | 3997 | 398 | 0 | 398 |
| 2010 | 2220 | 1776 | 3996 | 340 | -0 | 340 |

Table 3
OCS Employment Assumptions for Unalaska
Sale 89 Impact Case

| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL ON-SITE JOBS IN OR NEAR THIS COMMUNITY (Including Jobs Held by Transient Workers Who Rotate to Permanent Residences in Other Communities) | 33 | 41 | 11 | 12 | 11 | 46 | 60 | 110 | 325 | 252 | 157 | 125 | 157 | 157 | 157 | 157 | 147 | 126 |
| SHORT-TERM JOBS | | | | | | | | | | | | | | | | | | |
| Skilled | 0 | 1 | 2 | 3 | 2 | 17 | 33 | 41 | 47 | 21 | 31 | 18 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unskilled | 33 | 41 | 9 | 9 | 9 | 23 | 51 | 69 | 278 | 231 | 41 | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| LONG-TERM JOBS | | | | | | | | | | | | | | | | | | |
| Skilled | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 17 | 17 | 17 | 17 | 15 | 12 |
| Unskilled | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 0 | 0 | 0 | 78 | 78 | 141 | 141 | 141 | 141 | 132 | 114 |
| TOTAL JOBS OFFSHORE FROM THIS COMMUNITY | 0 | 7 | 28 | 26 | 28 | 77 | 128 | 153 | 170 | 75 | 126 | 152 | 138 | 138 | 138 | 198 | 182 | 144 |
| SHORT-TERM JOBS | | | | | | | | | | | | | | | | | | |
| Skilled | 0 | 7 | 28 | 26 | 28 | 77 | 128 | 153 | 170 | 76 | 125 | 62 | 0 | 0 | 0 | 0 | 2 | 0 |
| Unskilled | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| LONG-TERM JOBS | | | | | | | | | | | | | | | | | | |
| Skilled | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 93 | 93 | 138 | 198 | 198 | 198 | 182 | 144 |
| Unskilled | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

e: Minerals Management Service, Alaska OCS Office. Title and notes for original table: "Table 6: OCS Employment In or Offshore from U due to Proposed Sale 89—Mean Case." Printed at 3 p.m., Sunday, October 7, 1984, by J. Sullivan.

TABLE A.2. RURAL ALASKA MODEL PROJECTIONS
UNALASKA
SALE 89 REVISED IMPACT CASE

Population

| | Resident | Native | Non-Native | Native Male | Native Female | Non-Native Male | Non-Native Female |
|---|---|---|---|---|---|---|---|
| 1981 | 687 | 206 | 481 | 123 | 83 | 304 | 177 |
| 1982 | 665 | 212 | 454 | 125 | 87 | 286 | 167 |
| 1983 | 652 | 217 | 435 | 127 | 90 | 274 | 160 |
| 1984 | 791 | 223 | 569 | 130 | 93 | 359 | 209 |
| 1985 | 785 | 228 | 557 | 132 | 96 | 352 | 205 |
| 1986 | 823 | 234 | 589 | 134 | | 372 | 217 |
| 1987 | 906 | 239 | 667 | 136 | 1:; | 421 | 246 |
| 988 | 896 | 244 | 652 | 138 | 106 | 412 | 240 |
| 989 | 917 | 250 | 668 | 141 | 109 | 422 | 246 |
| 990 | 999 | 255 | 744 | 143 | 112 | 470 | 274 |
| 991 | 1130 | 260 | 870 | 145 | 115 | 549 | 320 |
| 992 | 1191 | 265 | 925 | 147 | 119 | 584 | 341 |
| 993 | 1374 | 271 | 1104 | 149 | 122 | 697 | 407 |
| 1994 | 1443 | 276 | 1167 | 151 | 125 | 737 | 43(I |
| 1995 | 1698 | 281 | 1417 | 153 | 128 | B95 | 522 |
| 1996 | 1834 | 287 | 1547 | 155 | 132 | 977 | 570 |
| 1997 | 2246 | 292 | 1953 | 157 | 135 | 1233 | 720 |
| 1998 | 2424 | 298 | 2126 | 160 | 139 | 1343 | 783 |
| 1999 | 2716 | 304 | 2412 | 162 | 142 | 1523 | 889 |
| 2000 | 2676 | 310 | 2367 | 164 | 146 | 1495 | 872 |
| 2001 | 2671 | 316 | 2356 | 166 | 149 | 1488 | 868 |
| 2002 | 2666 | 322 | 2344 | 169 | 153 | 1480 | 864 |
| 2003 | 2662 | 328 | 2334 | 171 | 157 | 1474 | 860 |
| 2004 | 2659 | 334 | 2325 | 174 | 161 | 1468 | 857 |
| 2005 | 2628 | 341 | 2287 | ?76 | 165 | 1444 | 843 |
| 2006 | 2624 | 347 | 2277 | 179 | 169 | 1438 | 839 |
| 2007 | 2622 | 354 | 2268 | 182 | 173 | 1432 | 836 |
| 2008 | 2620 | 361 | 2259 | 184 | 177 | 1427 | 832 |
| 2009 | 2619 | 368 | 2250 | 187 | 181 | 1421 | 829 |
| 2010 | 2560 | 376 | 2184 | 190 | 185 | 1379 | 805 |

SOURCE: VARIABLES PO, PONA, PONN, PONAMA, PONAFE, PONNMA, AND PONNFE
DSET UN.89IC--CREATED 10/8/84

TABLE A.4. RURAL ALASKA MODEL PROJECTIONS
UNALASKA
SALE 89 REVISED IMPACT CASE

| | Resident Population | Change in Resident Population | Natural Increase | Net Migration |
|---|---|---|---|---|
| 1981 | 687 | -37 | 8 | -46 |
| 1982 | 665 | -22 | 7 | -28 |
| 1983 | 652 | -13 | 6 | -20 |
| 19s4 | 791 | 140 | 6 | 133 |
| 1985 | 785 | -6 | 7 | -13 |
| 1986 | 823 | 37 | 6 | 31 |
| 1987 | 906 | 84 | 6 | 77 |
| 1988 | 896 | -10 | 7 | -17 |
| 1989 | 917 | 21 | 7 | 14 |
| 1990 | 999 | 82 | 7 | 76 |
| 1991 | 1130 | 130 | 7 | 124 |
| 1992 | 1191 | 61 | 7 | 54 |
| 1993 | 1374 | 184 | 7 | 177 |
| 1994 | 1443 | 68 | 8 | 61 |
| 1995 | 1698 | 2 5 6 | 8 | 248 |
| 1996 | 1834 | 136 | 8 | 127 |
| 1997 | 2246 | 4?2 | 9 | 403 |
| 1998 | 2424 | 179 | 9 | 169 |
| 1999 | 2716 | 292 | 10 | 282 |
| 2000 | 2676 | -39 | 11 | -50 |
| 2001 | 2671 | -5 | 10 | -15 |
| 2002 | 2666 | -5 | 11 | -16 |
| 2003 | 2662 | -4 | 11 | -15 |
| 2004 | 2659 | -2 | 11 | -13 |
| 2005 | 2628 | -32 | 11 | -43 |
| 2006 | 2624 | -4 | 11 | -1'4 |
| 2007 | 2622 | -2 | 11 | -13 |
| 2008 | 2620 | -2 | 11 | -13 |
| 2009 | 2619 | -2 | 11 | -13 |
| 2010 | 2560 | -59 | 12 | -70 |

SOURCE : VARIABLES PO, CHPO, NTIC, AND IM
DSET UN.89IC--CREATED 10/8/84

TABLE A.6. RURAL ALASKA MODEL PROJECTIONS
UNALASKA
SALE 89 REVISED IMPACT CASE

| | Total Resident Employment | Resident Baste Employment | Resident Support Employment | Resident Government Employment | Resident Project Employment |
|---|---|---|---|---|---|
| 1981 | 368 | 110 | 167 | 91 | 0 |
| 1982 | 352 | 110 | 143 | 99 | 0 |
| 1983 | 341 | 110 | 137 | 94 | 0 |
| 1984 | 426 | 116 | 164 | ?25 | 21 |
| 1985 | 419 | 122 | 164 | 124 | 10 |
| 19$6 | 440 | 128 | 172 | 129 | 11 |
| 1987 | 490 | 134 | 193 | 133 | 29 |
| 1988 | 481 | 140 | 186 | 145 | 9 |
| 1989 | 491 | 155 | 191 | 143 | 2 |
| 1990 | 539 | 170 | 209 | 155 | 6 |
| 1991 | 618 | 200 | 235 | 174 | 9 |
| 1992 | 654 | 230 | 253 | 153 | 13 |
| 1993 | 765 | 260 | 296 | 171 | 37 |
| 1994 | 805 | 290 | 309 | 173 | 34 |
| 1995 | 962 | 320 | 353 | 189 | 100 |
| 1996 | 10.44 | 350 | 380 | 190 | 124 |
| 1997 | 1298 | 380 | 454 | 226 | 237 |
| 1998 | 1407 | 410 | 482 | 237 | 277 |
| 1999 | 1586 | 410 | 527 | 264 | 385 |
| 2000 | 1559 | 410 | 517 | 257 | 375 |
| 2001 | 1553 | 410 | 516 | 252 | 375 |
| 2002 | 1547 | 410 | 515 | 247 | 375 |
| 2003 | 1541 | 410 | 514 | 243 | 3'75 |
| 2004 | 1537 | 410 | 513 | 239 | 375 |
| 2005 | 1574 | 410 | 507 | 233 | 364 |
| 2006 | 1509 | 410 | 506 | 229 | 364 |
| 2007 | 1505 | 410 | 505 | 226 | 364 |
| 2008 | 1501 | 410 | 504 | 223 | 364 |
| 2009 | 1497 | 410 | 503 | 219 | 364 |
| 2010 | 1457 | 410 | 493 | 211 | 343 |

SOURCE: VARIABLES EMRETO, EMBA, EMSU, EMGO, AND EMREPJ
OSET UN.891C--CREATED 10/8/84

TABLE A.8. RURAL ALASKA MODEL PROJECTIONS
UNALASKA
SALE 89 REVISED IMPACT CASE

| | Total Resident Support Employment | Endogenous Resident Support Employment | Government Sponsored Resident Support Employment | Exogenous Resident Support Employment | Enclave Sponsored Resident Support Employment |
|---|---|---|---|---|---|
| 1981 | 167 | 76 | .0 | 59 | 32 |
| 1982 | 143 | 72 | 0 | 59 | 12 |
| 1983 | 137 | 70 | 0 | 59 | 9 |
| 1984 | 164 | 89 | 0 | 59 | 16 |
| 1985 | 164 | 87 | 0 | 59 | 18 |
| 1986 | 172 | 91 | 0 | 59 | 22 |
| 1987 | 193 | 104 | 0 | 59 | 31 |
| 1988 | 186 | 99 | 0 | 59 | 2$ |
| 1989 | 191 | 100 | 0 | 59 | 32 |
| 1990 | 209 | 110 | 0 | 59 | 39 |
| 1991 | 235 | 127 | 0 | 59 | 49 |
| 1992 | 253 | 134 | 0 | 59 | 59 |
| 1993 | 296 | 161 | 0 | 59 | 77 |
| 1994 | 309 | 168 | 0 | 59 | 81 |
| 1995 | 3.53 | 208 | 0 | 59 | 86 |
| 1996 | 380 | 228 | 0 | 59 | 94 |
| 1997 | 454 | 293 | 0 | 59 | 102 |
| 1998 | 482 | 321 | 0 | 59 | 103 |
| 1999 | 527 | 370 | 0 | 59 | 98 |
| 2000 | 517 | 364 | 0 | 59 | 94 |
| 2001 | 516 | 362 | 0 | 59 | 94 |
| 2002 | 515 | 361 | 0 | 5 9 | 94 |
| 2003 | 514 | 360 | 0 | 59 | 94 |
| 2004 | 513 | 359 | 0 | 59 | 94 |
| 2005 | 507 | 353 | 0 | 59 | 94 |
| 2006 | 506 | 352 | 0 | 59 | 94 |
| 2007 | 505 | 352 | 0 | 59 | 94 |
| 2008 | 504 | 351 | 0 | 59 | 94 |
| 2009 | 503 | 350 | 0 | 59 | 94 |
| 2010 | 493 | 339 | 0 | 59 | 94 |

SOURCE : VARIABLES EMSU, EMSUEG, EMSUGO, EMSUEX, AND EMSUEN
DSET UN.89IC--CREATED 10/8/84

TABLE A.10. RURAL ALASKA MODEL PROJECTIONS
UNALASKA
SALE 89 REVISED IMPACT CASE

| | Onshore Short-Term Skilled Project Employment | Onshore Short-Term Nonskilled Project Employment | Onshore Long-Term Skilled Project Employment | Onshore Long-Term Nonskilled Project Employment | Total Onshore Project Employment |
|---|---|---|---|---|---|
| 1981 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 33 | 107 | 0 | 0 | 140 |
| 1985 | 55 | 40 | 0 | 0 | 95 |
| 1986 | 48 | 48 | 0 | 0 | 96 |
| 1987 | 37 | 165 | 0 | 0 | 202 |
| 1988 | 15 | 41 | 0 | 0 | 56 |
| 1989 | 5 | 8 | 0 | 0 | 13 |
| 1990 | 23 | 29 | 0 | 0 | 52 |
| 1991 | 40 | 50 | 0 | 0 | 90 |
| 1992 | 51 | 69 | 0 | 0 | 120 |
| 1993 | 55 | 278 | 0 | 0 | 333 |
| 1994 | 27 | 231 | 0 | 0 | 258 |
| 1995 | 64 | 96 | 8 | 78 | 246 |
| 1996 | 84 | 131 | 26 | 78 | 319 |
| 1997 | 83 | 198 | 71 | 141 | 493 |
| 1998 | 39 | 145 | 116 | 141 | 441 |
| 1999 | 6 | 70 | 134 | 241 | 451 |
| 2000 | 0 | 0 | 134 | 241 | 375 |
| 2001 | 0 | 0 | 134 | 241 | 375 |
| 2002 | 0 | 0 | 134 | 241 | 375 |
| 2003 | 0 | 0 | 134 | 241 | 375 |
| 2004 | 0 | 0 | 134 | 241 | 375 |
| 2005 | 0 | 0 | 132 | 232 | 364 |
| 2006 | 0 | 0 | 132 | 232 | 364 |
| 2007 | 0 | 0 | 132 | 232 | 364 |
| 2008 | 0 | 0 | 132 | 232 | 364 |
| 2009 | 0 | 0 | 132 | 232 | 364 |
| 2010 | 0 | 0 | 129 | 214 | 343 |

SOURCE: VARIABLES EMPSONSK, EMPSONNS, EMPLONSK, EMPLONNS, AND EMPJON
DSET UN.89IC--CREATED 10/8/84

TABLE A.12. RURAL ALASKA MODEL PROJECTIONS
UNALASKA
SALE 69 REVISED IMPACT CASE

| | Resident Project Employment | Enclave Project Employment | Commuter Project Employment | Total Project Employment |
|---|---|---|---|---|
| 1981 | 0 | -o | 0 | 0 |
| 7982 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 0 | 0 | 0 |
| 1984 | 21 | 119 | 96 | 236 |
| 1985 | 10 | 85 | 156 | 251 |
| 1986 | 11 | | ?39 | 235 |
| 1987 | 29 | 1:: | 116 | 318 |
| 1988 | 9 | 47 | 74 | 130 |
| 1989 | 2 | 11 | 44 | 57 |
| 1990 | 6 | 46 | 137 | 189 |
| 1991 | 9 | 81 | 236 | 326 |
| 1992 | 13 | 1 07 | 266 | 386 |
| 1993 | 37 | 296 | 254 | 587 |
| 1994 | 34 | 224 | 136 | 394 |
| 1995 | 100 | 146 | 449 | 695 |
| 1996 | 124 | 195 | 730 | 1049 |
| 1997 | 237 | 256 | 1046 | 1539 |
| 1998 | 277 | 164 | 880 | 1321 |
| 1999 | 385 | 66 | 699 | 1150 |
| 2000 | 375 | 0 | 666 | 1041 |
| 2001 | 375 | o | 666 | 1041 |
| 2002 | 3'75 | 0 | 666 | 1041 |
| 2003 | 375 | 0 | 666 | 1041 |
| 2004 | 375 | 0 | 666 | 1041 |
| 2005 | 364 | 0 | 648 | 1012 |
| 2006 | 364 | 0 | 648 | 1012 |
| 2007 | 364 | 0 | 648 | 1012 |
| 2008 | 364 | 0 | 648 | 1012 |
| 2009 | 364 | 0 | 648 | 1012 |
| 2010 | 343 | 0 | 612 | 955 |

SOURCE: VARIABLES EMREPJ, EMENPJ, EMCOPJ, AND EMPJ
DSET UN.89IC--CREATED 10/8/84

## TABLE O-1
RURAL ALASKA MODEL PROJECTIONS
UNALASKA
SALE 89 MEDIUM BASE CASE

| | RESIDENT POPULATION | NON-PROJECT ENCLAVE POPULATION | PROJECT ENCLAVE POPULATION | MILITARY ENCLAVE POPULATION | TOTAL POPULATION INCLUDING ENCLAVES AND MILITARY |
|---|---|---|---|---|---|
| 1981 | 687 | 609 | -0 | 0 | 1296 |
| 1982 | 665 | 233 | 0 | 0 | 898″ |
| 1983 | 652 | 166 | 0 | 0 | 818 |
| 1984 | 791 | 186 | 119 | 0 | 1097 |
| 1985 | 756 | 262 | 60 | 0 | 1079 |
| 1986 | 788 | 337 | | 0 | 1177 |
| 1987 | 901 | 412 | 1:: | 0 | 1477 |
| 1988 | 888 | 488 | 37 | 0 | 1413 |
| 1989 | 910 | 593 | 3 | 0 | 1506 |
| 1990 | 974 | 699 | 6 | 0 | 1679 |
| 1991 | 1089 | 854 | 10 | 0 | 1953 |
| 1992 | 1139 | 1009 | 10 | 0 | 2158 |
| 1993 | 1223 | 1165 | 8 | 0 | 2396 |
| 1994 | 1313 | 1320 | 6 | 0 | 2639 |
| 1995 | 1427 | 1476 | 79 | 0 | 2982 |
| 1996 | 1579 | 1576 | 159 | 0 | 3314 |
| 1997 | 1608 | 1676 | 253 | 0 | 3737 |
| 1998 | 1985 | 1776 | 163 | 0 | 3924 |
| 1999 | 2275 | 1776 | 66 | 0 | 4117 |
| 2000 | 2235 | 1776 | 0 | 0 | 4011 |
| 2001 | 2233 | 1776 | 0 | 0 | 4009 |
| 2002 | 2229 | 1776 | 0 | 0 | 4005 |
| 2003 | 2227 | 1776 | 0 | 0 | 4003 |
| 2004 | 2226 | 1776 | 0 | 0 | 4002 |
| 2005 | 2224 | 1776 | 0 | 0 | 4000 |
| 2006 | 2223 | 1776 | 0 | 0 | 3999 |
| 2007 | 2222 | 1776 | 0 | 0 | 3998 |
| 2008 | 2221 | 1776 | 0 | 0 | 3997 |
| 2009 | 2221 | 1776 | 0 | 0 | 3997 |
| 2010 | 2220 | 1776 | 0 | 0 | 3996 |

SOURCE: VARIABLES PO, EMENNOPJ, EMENPJ, POML, AND POTO
DSET UN.89MBC--CREATED 11/30/83

TABLE O-3
RURAL ALASKA MODEL PROJECTIONS
UNALASKA
SALE 89 MEDIUM BASE CASE

| | RESIDENT POPULATION | PRE-SCHOOL AGE (0-4) | SCHOOL AGE (5-18) | ADULT (19-64) | SENIOR (65+) |
|---|---|---|---|---|---|
| 19s1 | 687 | 47 | 168 | 459 | 13 |
| 1982 | 665 | 50 | 160 | 442 | 14 |
| 1983 | 652 | 52 | 155 | 431 | 15 |
| 1984 | 791 | 63 | 186 | 525 | 17 |
| 1985 | 756 | 62 | 177 | 499 | 18 |
| 1986 | 788 | 66 | 184 | 518 | 20 |
| 1987 | 901 | 74 | 211 | 594 | 22 |
| 1988 | 888 | 74 | 208 | 583 | 23 |
| 1989 | 910 | 76 | 214 | 595 | 25 |
| 1990 | 974 | 81 | 230 | 637 | 27 |
| 1991 | 1089 | 89 | 257 | 714 | 29 |
| 1992 | 1139 | 92 | 269 | 746 | 31 |
| 1993 | 1223 | 98 | 290 | 802 | 33 |
| 1994 | 1313 | 104 | 311 | 862 | 36 |
| 1995 | 1427 | 112 | 338 | 939 | 38 |
| 1996 | 1579 | 122 | 374 | 1042 | 41 |
| 1997 | 1808 | 137 | 427 | 1199 | 45 |
| 1998 | 1985 | 149 | 468 | 1319 | 48 |
| 1999 | 2275 | 169 | 535 | 1518 | 53 |
| 2000 | 2235 | 166 | 527 | 1489 | 54 |
| 2001 | 2233 | 166 | 527 | 1485 | 55 |
| 2002 | 2229 | 166 | 527 | 1480 | 56 |
| 2003 | 2227 | 167 | 527 | 1477 | 57 |
| 2004 | 2226 | 167 | 527 | 1474 | 58 |
| 2005 | 2224 | 167 | 528 | 1470 | 59 |
| 2006 | 2223 | 168 | 528 | 1467 | 60 |
| 2007 | 2222 | 168 | 528 | 1464 | 61 |
| 2008 | 2221 | 169 | 529 | 1462 | 62 |
| 2009 | 2221 | 169 | 529 | 1459 | 63 |
| 2010 | 2220 | 170 | 530 | 1457 | 64 |

SOURCE: VARIABLES PO, POKD, POSL, POAT, AND POGE
DSET UN.89MBC--CREATED 11/30/83

TABLE O-5
RURAL ALASKA MODEL PROJECTIONS
UNALASKA
SALE 89 MEDIUM BASE CASE

| | RESIDENT EMPLOYMENT | NON-PROJECT ENCLAVE EMPLOYMENT | PROJECT ENCLAVE EMPLOYMENT (ONSHORE ONLY) | MILITARY ENCLAVE EMPLOYMENT | TOTAL EMPLOYMENT INCLUDING ENCLAVES AND MILITARY |
|---|---|---|---|---|---|
| 1981 | 368 | 609 | -0 | 0 | 977 |
| 198.2 | 352 | 233 | 0 | 0 | 585 |
| 1983 | 341 | 166 | 0 | 0 | 507 |
| 1984 | 426 | 186 | 119 | 0 | 731 |
| 1985 | 401 | 262 | 60 | 0 | 724 |
| 1986 | 419 | 337 | 52 | 0 | 808 |
| 1987 | 486 | 412 | 164 | 0 | 1062 |
| 1988 | 476 | 488 | 37 | 0 | 1000 |
| 1989 | 487 | 593 | 3 | 0 | 1083 |
| 1990 | 524 | 699 | 6 | 0 | 1229 |
| 1991 | 593 | 854 | 10 | o | 1457 |
| 1992 | 621 | 1009 | 10 | 0 | 1640 |
| 1993 | 671 | 1165 | 8 | 0 | 1844 |
| 1994 | 724 | 1320 | 6 | 0 | 2050 |
| 1995 | 793 | 1476 | 79 | 0 | 2347 |
| 1996 | 885 | 15?6 | 159 | 0 | 2619 |
| 1997 | 1025 | 1676 | 253 | 0 | 2954 |
| 1998 | 1133 | 1776 | 163 | 0 | 3071 |
| 1999 | 1311 | 1776 | 66 | 0 | 3153 |
| 2000 | 1284 | 1776 | 0 | 0 | 3060 |
| 2001 | 1279 | 1776 | 0 | 0 | 3055 |
| 2002 | 1274 | 1776 | 0 | 0 | 3050 |
| 2003 | 1270 | 1776 | 0 | 0 | 3046 |
| 2004 | 1266 | 1776 | 0 | 0 | 3042 |
| 2005 | 1262 | 1776 | 0 | 0 | 3038 |
| 2006 | 1259 | 1776 | 0 | 0 | 3035 |
| 2007 | 1255 | 1776 | 0 | 0 | 3031 |
| 2008 | 1252 | 1776 | 0 | 0 | 3028 |
| 2009 | 1248 | 1776 | 0 | 0 | 3024 |
| 2010 | 1245 | 1776 | 0 | 0 | 3021 |

SOURCE: VARIABLES EMRETO, EMENNOPJ, EMENPJ, EMML, AND EMTO
DSET UN.89MBC--CREATED 11/30/83

TABLE 0-7
RURAL ALASKA MODEL PROJECTIONS
UNALASKA
SALE 89 MEDIUM BASE CASE

| | TOTAL RESIDENT BASIC EMPLOYMENT | RESIDENT FISHING EMPLOYMENT | RESIDENT FISH PROCESSINS EMPLOYMENT | OTHER RESIDENT BASIC EMPLOYMENT |
|---|---|---|---|---|
| 1981 | 110 | 50 | 58 | 2 |
| 1982 | 110 | 50 | 58 | 2 |
| 1983 | 110 | 50 | 58 | 2 |
| 1984 | 116 | 52 | 62 | 2 |
| 1985 | 122 | 54 | 66 | 2 |
| 1986 | 128 | 56 | 70 | 2 |
| 1987 | 134 | 58 | 74 | 2 |
| 1988 | 140 | 60 | 78 | 2 |
| 1989 | 155 | 65 | 88 | 2 |
| 1990 | 170 | 70 | 98 | 2 |
| 1991 | 200 | 80 | 118 | 2 |
| 1992 | 230 | 90 | 138 | 2 |
| 1993 | 260 | 100 | 158 | 2 |
| 1994 | 290 | 110 | 178 | 2 |
| 1995 | 320 | 120 | 198 | 2 |
| 1996 | 350 | 130 | 218 | 2 |
| 1997 | 380 | 140 | 238 | 2 |
| 1998 | 410 | 150 | 258 | 2 |
| 1999 | 410 | 150 | 258 | 2 |
| 2000 | 410 | 150 | 258 | 2 |
| 2001 | 410 | 150 | 258 | 2 |
| 2002 | 410 | 50 | 258 | 2 |
| 2003 | 410 | 50 | 25a | 2 |
| 2004 | 410 | 50 | 258 | 2 |
| 2005 | 410 | 50 | 258 | 2 |
| 2006 | 410 | 50 | 258 | 2 |
| 2007 | 410 | 50 | 258 | 2 |
| 2008 | 410 | 50 | 258 | 2 |
| 2009 | 410 | 150 | 258 | 2 |
| 2010 | 410 | 150 | 258 | 2 |

SOURCE: VARIABLES EMBA, EMFI, EMFP, AND EMBANF
DSET UN.89MBC--CREATED 11/30/83

TABLE O-9
RURAL ALASKA MODEL PROJECTIONS
UNALASKA
SALE 89 MEDIUM BASE CASE

| | TOTAL CIVILIAN GOVERNMENT EMPLOYMENT | ENDOGENOUS CIVILIAN GOVERNMENT EMPLOYMENT | EXOGENOUS " CIVILIAN GOVERNMENT EMPLOYMENT |
|---|---|---|---|
| 1981 | 91 | 85 | 6 |
| 1982 | 99 | 93 | 6 |
| 1983 | 94 | 88 | 6 |
| 1984 | 125 | 119 | 6 |
| 1985 | 120 | 114 | 6 |
| 1986 | 124 | 118 | 6 |
| 1987 | 133 | 127 | 6 |
| 1988 | 144 | 138 | 6 |
| 1989 | 142 | 136 | 6 |
| 1990 | 151 | 145 | 6 |
| 1991 | 168 | 162 | 6 |
| 1992 | 152 | 146 | 6 |
| 1993 | 153 | 147 | 6 |
| 1994 | 158 | 152 | 6 |
| 1995 | 160 | 154 | 6 |
| 1996 | 164 | 158 | 6 |
| 1997 | 183 | 177 | 6 |
| 1998 | 195 | 189 | 6 |
| 1999 | 222 | 216 | 6 |
| 2000 | 215 | 209 | 6 |
| 2001 | 212 | 206 | 6 |
| 2002 | 208 | 202 | 6 |
| 2003 | 204 | 198 | 6 |
| 2004 | 201 | 195 | 6 |
| 2005 | 198 | 192 | 6 |
| 2006 | 195 | 189 | 6 |
| 2007 | 192 | 186 | 6 |
| 2008 | 190 | 184 | 6 |
| 2009 | 187 | 181 | 6 |
| 2010 | 184 | 178 | 6 |

SOURCE: VARIABLES EMGO, EMGOEG, AND EMGOEX
DSET UN.89MBC--CREATED 11/30/83

TABLE O-11
RURAL ALASKA MODEL PROJECTIONS
UNALASKA
SALE 89 MEDIUM BASE CASE

| | OFFSHORE SHORT-TERM SKILLED PROJECT EMPLOYMENT | OFFSHORE SHORT-TERM NONSKILLED PROJECT EMPLOYMENT | OFFSHORE LONG-TERN SKILLED PROJECT EMPLOYMENT. | OFFSHORE LONG-TERM NONSKILLED PROJECT EMPLOYMENT | TOTAL OFFSHORE PROJECT EMPLOYMENT |
|---|---|---|---|---|---|
| 1981 | 0 | 0 | 0 | 0 | “0 |
| 1982 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 96 | 0 | 0 | 0 | 96 |
| 1985 | 156 | 0 | -0 | 0 | 156 |
| 1986 | 132 | 0 | 0 | 0 | 132 |
| 1987 | 96 | 0 | 0 | 0 | 96 |
| 1988 | 48 | 0 | 0 | 0 | 48 |
| 1989 | 24 | 0 | 0 | 0 | 24 |
| 1990 | 60 | 0 | 0 | 0 | 60 |
| 1991 | 108 | 0 | 0 | 0 | 108 |
| 1992 | 108 | 0, | Q | 0 | 108 |
| 1993 | 84 | 0 | 0 | 0 | 84 |
| 1994 | 60 | 0 | 0 | 0 | 60 |
| 1995 | 253 | 0 | 0 | 0 | 253 |
| 1996 | 506 | 0 | 72 | 0 | 578 |
| 1997 | 632 | 0 | 216 | 0 | 848 |
| 1998 | 286 | 0 | 396, | 0 | 682 |
| 1999 | 33 | 0 | 468 | 0 | 501 |
| 2000 | -0 | 0 | 468 | 0 | 468 |
| 2001 | 0 | 0 | 468 | 0 | 468 |
| 2002 | 0 | 0 | 468 | 0 | 468 |
| 2003 | 0 | 0 | 468 | 0 | 468 |
| 2004 | 0 | 0 | 468 | 0 | 468 |
| 2005 | 0 | 0 | 468 | 0 | 468 |
| 2006 | -0 | 0 | 468 | 0 | 468 |
| 2007 | 0 | 0 | 468 | 0 | 468 |
| 2008 | 0 | 0 | 468 | 0 | 468 |
| 2009 | 0 | 0 | 468 | 0 | 468 |
| 2010 | 0 | 0 | 468 | 0 | 468 |

SOURCE: VARIABLES EMPSOFSK, EMPSOFNS, EMPLOFSK, EMPLOFNS, AND EMPJOF
DSET UN.89MBC--CREATED 17/30/83

TABLE O-13
RURAL ALASKA MODEL PROJECTIONS
UNALASKA
SALE 89 MED UM BASE CASE

| | TOTAL PROJECT EMPLOYMENT | RESIDENT PROJECT EMPLOYMENT | SKILLED PROJECT EMPLOYMENT | NONSKILLED PROJECT EMPLOYMENT | RESIDENT SKILLED PROJECT EMPLOYMENT | RESIDENT NONSKILLED PROJECT EMPLOYMENT |
|---|---|---|---|---|---|---|
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 236 | 21 | 129 | 107 | 0 | 21 |
| 1985 | 218 | 2 | 211 | 7 | 0 | 2 |
| 1986 | 186 | 2 | 179 | 7 | 0 | 2 |
| 1987 | 288 | 28 | 131 | 157 | 0 | 28 |
| 1988 | 92 | 7 | 60 | 32 | 0 | 7 |
| 1989 | 27 | 0 | 27 | 0 | 0 | 0 |
| 1990 | 66 | 0 | 66 | 0 | 0 | 0 |
| 1991 | 118 | 0 | 118 | 0 | 0 | 0 |
| 1992 | 118 | 0 | 118 | 0 | 0 | 0 |
| 1993 | 92 | 0 | 92 | 0 | 0 | 0 |
| 1994 | 66 | 0 | 66 | 0 | 0 | 0 |
| 1995 | 341 | 9 | 286 | 55 | 0 | 9 |
| 1996 | 772 | 35 | 662 | 110 | 18 | 17 |
| 1997 | 1183 | 82 | 985 | 198 | 54 | 28 |
| 1998 | 965 | 120 | 820 | 145 | 99 | 21 |
| 1999 | 794 | 227 | 624 | 170 | 117 | 110 |
| 2000 | 685 | 217 | 585 | 100 | 117 | 100 |
| 2001 | 685 | 217 | 585 | 100 | 117 | 100 |
| 2002 | 685 | 217 | 585 | 100 | 117 | 100 |
| 2003 | 685 | 217 | 585 | 100 | 117 | 100 |
| 2004 | 685 | 217 | 585 | 100 | 117 | 100 |
| 2005 | 685 | 217 | 585 | 100 | 117 | 100 |
| 2006 | 685 | 217 | 585 | 100 | 117 | 100 |
| 2007 | 685 | 217 | 585 | 100 | 117 | 100 |
| 2008 | 685 | 217 | 585 | 100 | 117 | 100 |
| 2009 | 685 | 217 | 585 | 100 | 117 | 100 |
| 2010 | 685 | 217 | 585 | 100 | 117 | 100 |

SOURCE: VARIABLES EMPJ, EMREPJ, EMPJSK, EMPJNS, EMREPJSK, AND EMREPJNS
DSET UN.89MBC--CREATED 11/30/83

## Appendix B-5

## Environmental Impact Statement

UNITED STATES
DEPARTMENT OF THE INTERIOR

FINAL
ENVIRONMENTAL IMPACT STATEMENT
April 1985

Proposed
St. George Basin
Sale 89

Prepared by
Minerals Management Service

e

Limited air-support facilities would be needed at Balboa Bay to handle personnel and cargo flights from Cold Bay.

Marine support for the southern development would occur out of Unalaska/Dutch Harbor. Since five platforms would be serviced out of this port limited expansion of existing facilities might be necessary.

Marine support facilities also would be needed to support the LNG terminal at Balboa Bay.

c. Development Timetable: The exploratory period could begin in 1986 and end in 1993. A total of 12 exploratory wells and 15 delineation (9 oil/6 gas) wells are projected to be drilled during that period (Table II-2).

The development period is projected to begin in 1990 with the construction of one offshore oil platform and the drilling of four wells. All oil platforms could be in place by 1994. Construction of six gas platforms could start in 1992 and be completed by 1995. Between 1990 and 1996 a total of 108 production and service wells (62 oil/46 gas) would be drilled in the entire planning unit.

Pipeline construction is expected to start in 1993 and be completed by 1996. The trunk lines in the northern subunit are each projected to be 100 miles in length. The gas line in the southern subunit could be 160 miles in length offshore and 40 miles long overland.

Oil production is expected to" begin in 1994. Peak production could occur between 1996 and 2001 with a yearly rate of 94 MMbbls. All oil production probably would cease during 2014.

Gas production is expected to begin in 1996 and end sometime during 2020. Between 1998 and 2015, the yearly production rate will be 442 BCF.

d. Estimated Production Effluents: Estimated amounts of production effluents include the discharge of an estimated 11.24 to 1,011.6 MMbbls of produced waters and an average of 60,500 gallons/day of treated sanitary and domestic wastes from platforms. Drilling mud solids are estimated to be 28,350 tons. Drill cuttings could reach 18,900 tons. Yearly estimates, as related to the production schedule (Table II-2), can be found in Table IV-2.

e Population Projections: The scenario for the St. George Basin (Sale 89) identifies the communities of Unalaska, Cold Bay, and St. George as potential hosts for petroleum-industry personnel and operations. Due to model limitations, it was possible only to make population projections for Unalaska and Cold Bay using the Rural Alaska Model (RAM) of the Institute of Social and Economic Research, University of Alaska (Nebesky and Knapp, 1984). Potential levels of employment and population growth were projected for these communities through the year 2010, representing a 30-year forecast period, for potential development under lease-sale conditions and without the lease sale. St. George was too small in population size to use the RAM forecasting model, but other means were used and a discussion is included on the potential levels of population with, and in the absence of, the lease

| Year | Produced Waters (MMbbls) | Exploration- and Delineation-Derived Solids Cuttings (t) | Exploration- and Delineation-Derived Solids Muds (t) | atform-Derived Domest = and Sanitary Wastes (gal/day) | Sediments Disturbed by Pipe-laying Activ. ($yd^3$) |
|---|---|---|---|---|---|
| 1985 | - | - | - | - | - |
| 1986 | - | 700 | 1,050 | - | - |
| 1987 | - | 2,100 | 3,150 | - | - |
| 1988 | - | 2,800 | 4,200 | - | - |
| 1989 | - | 2,100 | 3,150 | - | - |
| 1990 | - | 3,500 | 5,250 | 5,500 | - |
| 1991 | - | 4,200 | 6,300 | 16,500 | 385,000-923.○00 |
| 1992 | - | 2,800 | 4,200 | 33,000 | 385,000-923,∘00 |
| 1993 | - | 700 | 1,050 | 49,500 | 385,000-923,∘00 |
| 1994 | - | - | - | 55,000 | 385,000-923,-00 |
| 1995 | .280-25.2 | - | - | 60,500 | - |
| 1996 | .940-84.6 | - | - | 60,500 | - |
| 1997 | .940-84.6 | - | - | 60,500 | - |
| 1998 | .940-84.6 | - | - | 60,500 | - |
| 1999 | .940-84.6 | - | - | 60,500 | - |
| 2000 | .940-84.6 | - | - | 60,500 | - |
| 2001 | .940-84.6 | - | - | 60,500 | - |
| 2002 | .830-74.7 | - | - | 60,500 | - |
| 2003 | .730-65.7 | - | - | 60,500 | - |
| 2004 | .640-57.6 | - | - | 60,500 | - |
| 2005 | .540-48.6 | - | - | 60,500 | - |
| 2006 | .480-43.2 | - | - | 60,500 | - |
| 2007 | .410-26.1 | - | - | 60,500 | - |
| 2008 | .360-32.4 | - | - | 60,500 | - |
| 2009 | .330-29.7 | - | - | 60,500 | - |
| 2010 | .290-26.1 | - | - | 60,500 | - |
| 2011 | .260-23.4 | - | - | 60,500 | - |
| 2012 | .240-21.6 | - | - | 60,500 | - |
| 2013 | .210-18.9 | - | - | 60,500 | - |
| 2014 | - | - | - | 33,000 | - |
| 2015 | | | | 33,000 | |
| Totals | 11.24-1,011.6 | 18,900 | 28,350 | 60,500* | 1.54-3.69 Million |

*Dailv averag= for plat orms

Source: MMS, 984.

sale. This discussion presents the population projections resulting from modeling and other means as conditions for considering a variety of potential social systems effects.

Ease-Case Projections (Excluding the Lease Sale):

Base-case projections for Unalaska and Cold Bay (see Appendix I) do not include activities associated with the sale under consideration. However, the base case does include assumptions about activities in the St. George Basin (Sale 70) and Navarin Basin (Sale 83) areas, which are reflected in the category of "project enclave population" for the base case. The other active category of enclave population, "nonproject enclave population," is found largely in Unalaska and is comprised principally of personnel of the seafood-processing industry.

Under conditions of base-case projections, Unalaska experiences little movement in population growth over the first 8 to 10 years of the projection. This is followed by modest population increases, until a leveling trend appears near the turn of the century. During peak periods of OCS-related population presence (1987 and 1997), such er.clave-type population accounts for not more than 7 toll percent of the total population of Unalaska. OCS-related population in Cold Bay accounts for a larger proportion of total population during peak periods (1987 and 1998) than in Unalaska, because of Cold Bay's smaller population base. On rhe whole, however, the resident population of Cold Bay in the base case declines to a lowofaround 150 in 1995 and then increases to, but does not substantially exceed, the 200 level.

In the absence of a RAM projection for St. George, a recent projection is used that was prepared for an economic strategies plan for the community, as shown in Appendix I, Table 3. This approximate 10-year projection is fairly optimistic in assuming that jobs can be created for existing as well as returning Aleut residents on the island. Some 25 former residents, each having one dependent, as well as 10 retired persons are anticipated to return for employment over the next decade. Between 1984 and 1?95, *St.* George is expected to increase in resident population from 215 t'o 271 persons. Part-time residents are expected to vary, with construction projects making the largest contribution.

Projections Including the Lease Sale:

The population projections associated with the lease sale for Unalaska and Cold Bay (see Appendix I) include the resident population and three categories. (nonproject, project, and military) of enclave population. In the case of each community, lease sale (project) enclave population is introduced in 1984 and terminated in 1999. The peak period of enclave population present in Unalaska is 1993 and 1994, whereas two peak periods are evident in Cold Bay, in 1986 and 1987 and in the years 1993 and 1994. The net differences between the base and effects cases for resident and enclave populations in Unalaska and Cold Bay are shown in Tables IV-3 and IV-4. According to these data, the net effect of the proposed lease sale on population, as an incremental addition to the base case, would be to increase resident population in Unalaska from 3 to 20 percent and in Cold Bay from 2 to 42 percent. The lease sale-associated enclave population in Unalaska would comprise not more than 5 percent of total enclave population. This would be expected to take place

Table IV-3
Rural Alaska Model Projections
St. George Basin Lease Sale (Sale 89)
Unalaska

Resident Population

| Year | Base Case | Lease Sale Case | Added By Lease Sale | Percent of Change | Percentage of Total |
|---|---|---|---|---|---|
| 1985 | 756 | 756 | 0 | 0 | 0 |
| 1990 | 974 | 999 | 25 | 2.6 | 2.5 |
| 1995 | 1,427 | 1,698 | 271 | 19.0 | 16.0 |
| 2000 | 2,235 | 2,676 | 441 | 19.7 | 16.5 |
| 2005 | 2,224 | 2,628 | 404 | 18.2 | 15.4 |
| 2010 | 2,220 | 2,560 | 340 | 15.3 | 13.3 |

Enclave Population

| Year | Base Case | Lease Sale Case | Added By Lease Sale | Percent of Change | Percentage of Total |
|---|---|---|---|---|---|
| 1985 | 322 | 322 | 0 | 0 | 0 |
| 1990 | 705 | 745 | 40 | 5.7 | 5.4 |
| 1995 | 1,555 | 1,622 | 67 | 4.3 | 4.1 |
| 2000 | 1,776 | 1,776 | 0 | 0 | 0 |
| 2005 | 1,776 | 1,776 | n | 0 | 0 |
| 2010 | 1,776 | 1,776 | 0 | 0 | 0 |

Alaska Native Population as Proportion of Total Resident Population

| Year | Base Case | Lease Sale Case | Difference |
|---|---|---|---|
| 1985 | 30.2 | 30.2 | 0 |
| 1990 | 26.2 | 25.5 | 0.7 |
| 1995 | 19.7 | 16.5 | 3.2 |
| 2000 | 13.9 | 11.0 | 2.3 |
| 2005 | 15.3 | 13.0 | 2.3 |
| 2010 | 10.9 | 14.7 | [illegible] |

Source: Nebesky and Knapp, 1984.

Table IV-4
Rural Alaska Model Projections
St. George Basin Lease Sale (Sale 89)
Cold Bay

| Resident Population | | | | | |
|---|---|---|---|---|---|
| Year | Base Case | Lease Sale Case | Added By Lease Sale | Percent of Change | Percentage of Total |
| 1985 | 186 | 186 | 0 | 0 | 0 |
| 1990 | 159 | 162 | 3 | 1.9 | 1.9 |
| 1995 | 156 | 323 | 167 | 107.1 | 51.7 |
| 2000 | 211 | 511 | 300 | 142.2 | 58.7 |
| 2005 | 210 | 488 | 278 | 132.4 | 57.0 |
| 2010 | 209 | 445 | 236 | 112.9 | 53.0 |

| Enclave Population | | | | | |
|---|---|---|---|---|---|
| Year | Base Case | Lease Sale Case | Added By Lease Sale | Percent of Change | Percentage of Total |
| 1985 | 76 | 76 | 0 | 0 | 0 |
| 1990 | 10 | 49 | 39 | 390.0 | 79.6 |
| 1995 | 10 | 54 | 44 | 440.0 | 81.5 |
| 2000 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 0 | 0 | 0 | 0 | 0 |

Source: Nebesky and 'Knapp, 1984.

only around 1990. Project-associated enclave population would constitute a high proportion of total enclave population in Cold Bay in 1990 and 1995, but this amount of population would not be as numerically dramatic. The proportion of total resident population attributed to Alaska Natives would decline marginally in Unalaska (3% or less) as a result of the proposed sale.

In the absence of a RAM projection for St. George, the potential population effects from the lease sale can be derived from the estimates of direct employment associated with the sale, since the majority of employees of nonlocal origin are assumed to be situated on-site, generally without dependents. As shown in Appendix I, Table 6, a period of peak employment is initiated by the lease sale beginning in 1986 with 63 employees. A subsequent peak of 736 employees occurs in 1995, with long-term employment also starting in 1995. From 256 to 300 employees are associated with lease sale activities on St. George Island over the long-term life of the project,

2. Oil Spill Risk Analysis:

a. Estimated Quantity of Resource: Considerable uncertainty exists in estimating the volume of oil that may be discovered and produced as a result of an OCS lease sale. The oil resource levels used in this EIS for the oil spill-risk calculations correspond to mean-case estimates. There is, however, an important qualification in the way that resource levels are used in this EIS. The resource estimates used in predicting the number of spills expected over the life of the field, and in the oil spill risk analysis for this EIS, are based on the "unrisked" mean case estimates. This is the assumption that the resource will be discovered and produced. Obviously, if hydrocarbons are not discovered, there would be no risk of a major spill. The projected number of spills and, accordingly, the results of the oil spill-risk analysis, reflect the expected oil spill risks based on a mean resource level of 1.124 Bbbls of oil for the St. George Basin (Sale 89).

b. Probability of Oil Spills Occurring: The probability of oil spill occurrence, as used in the oil-spill-risk analysis, is based on the assumption that future spill frequencies can be basea on past CCS experience. This analysis assumes that spills occur independently of each other and that the spill rate is dependent on the volume of oil produced or transported. This last assumption--spill rate is a function of the volume of oil handled--might be modified on the basis of size, extent, frequency, or duration of the handling. In the case of canker transport, for example, the number of port calls and the number of tanker years have beer. considered (Stewart, 1976; Stewart and Kemedy, 1978). This analysis uses volume of oil handled, because other bases for estimates of spill frequency are necessarily derived from this quantity.

Spill Size: This analysis examines spills in two size ranges: 100,000 barrels or greater (being representative of a worst-case spill) and 1,000 barrels or greater (which also includes 100,000-barrels or greater spills). To place these sizes in perspective to the type of accident usually involved, spills in the larger category are generally associated with catastrophes such as large blowouts or shipwrecks. Spills in the smaller category typically include these and other serious events, such as structural failures and collisions. The choice of the spill size to use depends upon the analysis to for lost fishing time. Collisions with fishing vessels would be at the rate of one every 79 years as of 1997, instead of the projected rate of one every 69 years without oil industry development.

The port of Dutch Harbor/Unalaska would likely be the major marine-support staging area for almost all Bering Sea oil development activities. Harbor congestion from the cumulative lease sales would probably be minimal, considering current plans for dedicated oil industry dot-k space in Captain's Bay, which is located south of the major concentration of fishing industry activity. Competition for labor would also be minimal, with the possibility of a positive benefit from additional employment opportunities during periods of poor earnings in the fisheries. Further, the increase in local availability of repair services could also benefit the fishing industry.

The number of oil spills projected for all of the Bering Sea lease areas, including tankering from the Norton Sound and Barrow Arch areas and Canada, would be 12 spills of 1,000-barrels or greater. Considering that these spills would occur over all of the Bering Sea lease areas, and over the varying periods of exploration and development of each field (35 years or greater), it is conceivable that only a relatively small area would be affected by a spill at any one time. The severity of effect on commercial fisheries would depend on what area the spill occurred in: some relatively small areas of the Bering Sea are very productive fisheries where activity and gear are concentrated and where catch and income loss due to gear fouling or closures could be high if a spill occurred during the fishing season. On the other hand, many other areas contain very low concentrations or no fish, so commercial fisheries would be only negligibly affected or not affected at all by a spill. Generally, inner Bristol Bay, the Aleutians near Unimak Pass, the area north of Unimak Pass as far as 57°N. latitude, and the Pribilof Islands area are locations where an oil spill could damage to commercial fisheries operations.

A spill contacting a major salmon- or herring-fishing area immediately prior to or during the harvest could result in closure of the grounds and a subsequent loss of thousands to millions of dollars to the industry. An occurrence such as this in inner Bristol Bay would be considered a major effect on the salmon industry. The Oil-Spill-Risk Analysis for the North Aleutian Basin, however, shows probabilities less than 0.5 percent of an oil spill of 1,000 barrels or greater occurring and contacting any nearshore areas in inner Bristol Bay.

Oil spills from other lease areas in the Bering Sea appear to pose no risk to inner Bristol Bay areas. "

Conclusion (Effects on Commercial Fishing Industry):

Overall, cumulative effects on the southeastern Bering Sea fisheries are likely to be NEGLIGIBLE, in that annual losses would represent only a small percentage of this region's fisheries which are projected to exceed $400 million in ex-vessel values (in 1982 dollars) in the year 2007 (Centaur Associates, 1984).

(2) Effects on Sociocultural Systems: This discussion focuses on those communities identified in the scenario that potentially could host some aspect of petroleum industry operations or that could otherwise be

affected by activities associated with the lease sale. These communities include Unalaska as a ❑arine-support base, Cold Bay as an air- support base, St. George--on the Pribilof Islands--as a secondary air-support base and the site of an oil and gas terminal, and Sand Point, the community on the Alaska Peninsula that could be directly affected by LNG terminal operations at Balboa Bay. For the purpose of effects assessment, it is assumed that effects on sociocultural systems (social, political, and cultural systems of organization) could be brought about through the addition of population and other social forces resulting from the lease sale. Potential effects on sociocultural systems are evaluated relative to the central tendency of newly introduced social forces to support or disrupt existing systems and the relative duration of such behavior.

As shown in the population projections (Sec. IV.A.1.e.), the lease sale would contribute less than 17 percent of resident or enclave population in Unalaska at any given time over the expected life of the project. This growth associated with the lease sale may produce effects on sociocultural systems at Unalaska, but these should be marginal at best in relation to those generated at the same time (the base case projection) by fisheries-oriented development.

In Cold Bay, the lease sale would contribute from 2 to 59 percent of total resident population, representing population increases of from 2 to more than 100 percent. From 1995 onward, the lease sale contributes more resident population than that expected to be in the community in the absence of the lease sale. This more than doubling of the resident population in Cold Bay would represent a long-term prospect of chronic disruption for the community; but, the effects on sociocultural systems may trend less toward displacement as the reinforcement of existing institutions and characteristics of the community,

The similarity in employment relations expected to be associated with OCS-related activity to those currently found in Cold Bay (specified tours of duty, mostly institutionally provided billets, basic hiring occurring prier to immigration, etc. ) and the resulting character of the population that can be expected from such relations (largely Caucasian, urban-oriented, outward-associated, little or no local kin linkages, ccc. ) should co little to change social and cultural patterns existing there, s ince the character of activity and cultural orientation of the persons expected to be involved should be compatible with the historical experience of the community. Despite the expectation of little basic change in social organization , however, this aspect of community may exhibit an increased tendency toward family formation within the community, and social differentiation by socioeconomic status may appear as a new form of group identity as the result of growth. Perhaps the 'widest avenue for chronic disruption of sociocultural systems may appear in political circles, in that the City of Cold Bay should experience increased pressure to make land and community facilities and services available to meet the expected demand of added residents. Such problems of managing community growth and development should affect both policy and administrative aspects of the governance structure, A grovth-management atmosphere of long-term conflict and disruption could increase factionalism within the community among existing and newly introduced economic and social actors.

Although the potential effects on sociocultural systems at Unalaska and Cold Bay may be relatively insignificant from a structural point of view, the introduction of an oil and gas terminal and related activities on St. George island offers the potential for considerable institutional change. Section IV.A.1.e. shows that annually there could be from 250 to 300 employees on the island who are associated in one way or another with the terminal and other lease-sale-related operations by 1995 and beyond, whereas there could be peak periods of construction on the island prior to this involving more than 600 employees. Employment of such proportions would dwarf the modest fisheries effort begun recently as a partial means of substituting for withdrawn government jobs associated with fur sealing.

As indicated in an earlier analysis of the potential effects of a similar project on St. Paul Island (Navarin Basin [Sale 83] FEIS, Appendix A [USDOI, 1983]), there could be major effects on Aleut sociocultural systems on St. George from changes in subsistence values, orientations and dependencies, and in the structure of the community itself. Changes in subsistence patterns could evolve from effects of oil and gas terminal activities on subsistence resources or if interaction with this new sector of the economy resulted in a tendency to diminish the values and orientation.s associated with subsistence-based living in an Orthodox community. On the other hand, employment of underemployed resident Aleuts in terminal and related operations could assist in filling the economic vacuum created by government withdrawal of fur-seal-industry support. Income so derived could improve living conditions in the context of withdrawal, although major dependence on a nonrenewable-zesozzce-based economy could have long-term social costs involved at the time Of resource depletion.

In terms of the community itself, changes in community leadership patterns and controlling factions could occur in the short-run from the negotiation and arbitration processes involved in siting terminals on the island. These changes could produce negative effects if the community were not able to maintain reasonable control over change processes. At the extreme, loss of such control could result in creating a non-Aleut-resident majority on the island interested in shaping a community more to their own liking. However, the high degree of awareness on the island for maintaining control over change, combined with their control over access to land through ownership by the St. George Tanaq Corporation, suggest that means exist for negotiating measures to mitigate potential long-term adverse effects on Aleut sociocultural systems if terminals were sited there.

On the Alaska Peninsula, the community of Sand Point could be effected by the operation of the LNG terminal and shipment point at Balboa Bay. Sane Point is situated due south of Balboa Bay on Popof Island, but at a distance possibly sufficient *to* encourage the development of an enclave population at the teminal site and lessen the possibility of resident population growth at Sand Point. However, population could occur in Sand Point from outsiders seeking employment at the terminal or from such aspects as growth in service industries , placement of a U.S. Coast Guard station in Sand Point, and construction of new housing. It is anticipated that a majority of the immigrants will be non-Natives.

The changes in population size and structure could have an effect on the social organization of Sand Point. The percentage of Aleuts to the total population is expected to be reduced in the absence of the lease sale, a trend which will be intensified with the lease sale. This will result in a magnification of the division between ethnic groups and, therefore, a more stratified society. The social organization of Sand Point will continue to be based primarily on kinship, with or without the lease sale; however, as population growth from immigration occurs, it is likely that there will be increases in voluntary organizations and a greater reliance on friendship-support networks.

As the Sand Point population grows, as outsiders move into the community, and as the percentage of Aleuts decreases, it is likely that there will be an increased trend toward a displacement of rural cultural values and orientations. Another factor which could decrease the value placed on fishing as a livelihood is the high percentage of students choosing to continue their education past high school; this is even more likely to occur as ocher types of employment become available and as the community grows. The increase in local-employment opportunities also will discourage outmigration by Sand Point residents.

Political ramifications could ensue at Sand Point from the proximity of the community to the LNG terminal, primarily as a short-term phenomenon associated with the disposition of the ad valorem-tax base represented by the terminal facility. The community of Sand Point may attempt to annex the terminal or others may seek to form a lower-peninsula borough to spread the tax benefits beyond a single community. Whatever the attempts employed or the results achieved, considerable relatively short-term political effects could be realized within Sand Point and perhaps elsewhere in the lower Alaska Peninsula subregion in terms of local governmental decisionmaking and possible state/community relations over the appropriate form of governmental organization for the area. In the long term, however, effects from the oil terminal should be sore economic than political in the public and private sectors.

SUMMARY (Effects on Sociocultural Systems):

Effects of the lease sale on the sociocultural systems of Unalaska are expected to be minimal and marginal compared to the effects of growth conditions expected to "be tree.ced by fisheries-oriented industrial development . In Cold Bay, the more than doubling of resident population with the lease sale produces a long-term prospect for chronic disruption of sociocultural systems within the community, but which are generally void of structural implications . The character of population and employment relations associated with lease sale activities are compatible with the historical, social, and cultural experience of the community, whereas the political system of organization would be subject to considerable stress in attempting to develop and carry out growth-management policies .

Siting an oil and gas terminal on St. George Island could produce adverse effects within the Orthodox community located there unless mitigated through local means. Depreciation of subsistence values and orientations could ensue from employment and other interaction with the new economic sector of St. George. Accommodating a sizable non-Aleut or non-Orthodox resident population on the island could hasten this depreciation as well as introduce the basis for creating a new controlling social force within the community . The mechanism for negotiating and maintaining countervailing growth-management policies appears to exist, however, through the village corporation's control of access to land on the island.

On the Alaska Peninsula, the population growth and economic activity associated with the operation of the LNG terminal at Balboa Bay could cause change in Sand Point to the extent of creating a more diversified and stratified community and perhaps hasten the trend toward displacement of traditional cultural values and orientations underway from the monetization of commercial fishing. Political ramifications could ensue locally and in the region from attempts to appropriate the terminal as a tax base, but such effects should be of snort-term duration.

CONCLUSION (Effects on Sociocultural Systems):

MODERATE effects on sociocultural systems are possible on St. George Island and in Cold Bay. Effects on sociocultural systems should be NEGLIGIBLE in Unalaska, but may reach MINOR proportions in Sand Point.

CUMULATIVE EFFECTS (Effects on Sociocultural Systems):

Cumulative effects on sociocultural systems in Unalaska, Cold Bay, on the Pribilof Islands, and in Sand point are assessed as the aggregate result of current trends in the absence of the lease sale (Sec. IV.B.2., Alternative 11), the lease sale itself, and other activities or projects identified in Section IV.A.6.b. as constituting additional causal agents for potential effects. For federal-OCS lease sales, exploration of the St. George Basin (Sale 70), and development of the Navarin Basin Lease Offering (April 1984) already are incorporated in the no-sale alternative. Beyond the proposed St. George Basin (Sale 89), other developments particularly pertinent to the communities of Unalaska and Cold Bay include the development of the St. George Basin (Sale 70) and the North Aleutian Basin (Sale 92) because of the roles prescribed for them in development scenarios. In each of these sales, Unalaska serves as the primary marine-support base for offshore operations. Cold Bay serves a similar function for air support as veil as being a focal point in the construction and operation of a transshipment oil and gas terminal on the southern side of the Alaska Peninsula. Other communities of the lower Alaska Peninsula also could be effected by the addition of an oil terminal to the LNG facility on Balboa Bay. The Norton Basin anc Barrow Arch lease areas are not served directly out of these communities, but tankering to market may increase the risk to subsistence resources on the Pribilof Islands, which in turn could affect local sociocultural systems.

In Unalaska, the predicted growth of groundfish-oriented industrial development, as discussed in Section IV.B.1.b. l., should be the driving force for change in local sociocultural systems. The OCS marine-support-base function plays a considerably more minor role. In the aggregate, however, the effect on sociocultural systems in Unalaska should be more of duration and degree of disruption than of institutional change beyond that which was initiated with the crab-industry boom. This should be true in Cold Bay as well, in that the character of the community, as discussed in Section III.C.2. , is not expected to substantially change as a result of serving a major air-support role and supporting the operation of an Alaska Peninsula oil and gas terminal because of the similarity in employment relations expected to be involved and the resultant character of the population that can be expected from such relations.

On the Pribilof Islands, adverse cumulative effects on subsistence resources (Sec. IV.B.1.b.(3) from southern Bering Sea lease sales and from tankering could contribute to increased levels of stress already set in motion by federal withdrawal from sealing. And, in this context, it would be tempting co court elements of the petroleum industry to establish facilities on either of the islands. If such were the case on either island, the potential for increased interisland rivalry and social disruption among extended families situated on both islands could arise and have disruptive effects on local sociocultural systems, but not to the extent of creating a tendency toward displacing Orthodox systems of behavior.

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On the Alaska Peninsula, effects on kinship relationships and cultural orientations could be magnified somewhat in the cumulative case by not only the increased risk to resources brought on by an increased volume of tankering through Unimak Pass and to and from the southern Peninsula terminal, but also by state onshore oil and gas lease Sales 41 and 56, which (if successful) would increase the likelihood of need for an ice-free-terminal site on the Alaska Peninsula.

Conclusion: MODERAT% cumulative effects on sociocultural systems are expected in Unalaska, Cold Bay, on the Pribilof Islands, and in Sand Point.

(3) Effects on Subsistence-Use Patterns: As defined in Sec. 803 of the Alaska National Interest Lands Conservation Act (P.L. 96-487), "the term 'subsistence uses' means the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade." The term "subsistence-use" carries the same meaning in this discussion. Within this context, the term "subsistence-use patterns" has a harvest connotation, as expressed in the definition.s for levels of effect used in this analysis (see Table S-2). As shown by the description of existing and potential future subsistence-use patterns in selected communities (Sec. III.C.3.), such patterns include the types of rest'~=:es used, the seasonality of the harvest, and the degree of use of such resources in the diet of local residents. Discussion of the cultural significance of harvest and subsequent distributional or other patterns of behavior is reserved for the previous section on sociocultural systems. This discussion focuses on the communities (Unalaska, Cold Bay, and St. George) assumed to host petroleum industry operations in support of the proposed lease sale and those nonhost communities (Nelson Lagoon and Sand Point) that could be affected by an LNG terminal and shipping point on Balboa Bay. In these communities, potential changes in the patterns of subsistence resources use as a result of the lease sale are assessed in relation to population increases and risks to resources posed by potential oil-spill incidents. In each case, potential effects are assessed in relation to current trends in each community brought about in the absence of the lease sale, as discussed in Section IV-?-?- On the Pribilof Islands, the community of St. Paul, as well as St. George, is included because of the common subsistence resources base.

As shown in the population projections (Sec. IV.A.1.e.), the lease sale would contribute less than 17 percent of total resident (approximately 440 out of a total of 2,676 in the year 2000) or enclave (67 out of 1,622 in 1995) popula-

Subsistence-use patterns (caribou and salmon) at Sand Point (also described in Sec. III.C.3.) could be affected if the Alaska Peninsula LNG terminal were to attract service industries, Coast Guard-family housing (as in Valdez), or migrants attracted to the community in hopes of finding work. The level of effect from population increases, however, should be minimal. Salmon and other marine subsistence resources are relatively plentiful and potentially not subject to harvest conflict. Terrestrial wildlife, especially moose and caribou, must be hunted on the mainland, a condition which should limit access to such resources due to the transportation costs involved. Residents normally fly or use the family fishing vessel for such excursions, whereas newcomers likely would have less access due to the level of technology owned or discretionary income available. The LNG terminal facility could pose a certain level of risk to marine resources near Sand Point from chronic discharges, such as from a ballast-treatment plant. However, such effects should be minimal in comparison with the potential risk that could be posed by an oil-shipment point.

SUMMARY (Effects on Subsistence-use Patterns):

Subsistence-use patterns on the Pribilof Island would be adversely affected if the fur seai population were subject to an oil spill, to the extent that the total annual supply of fur seal meat could be reduced for St. George and St. Paul residents by from 50 to 100 percent. The residents of the Pribilofs (approximately 1,000 people) are dependent on fur seal meat for 45 to so percent of their diet. This outcome should be the case whether or not there are direct biological effects in terms of abundance or distribution (as discussed under biological analysis) of the fur seal herd. An oil spill incident could cause the NMFS to terminate or vastly reduce the commercial and/or subsistence-fur seal harvest for that length of time necessary to determine the effects on the fur seal population. This length of time could conceivably be for more than a year.

Elsewhere, effects on subsistence-use patterns should be negligible in relation to the effects already visited on the residents of Unalaska by the fisheries-oriented growth and development. The enclave population at Balboa Bay for the LNG paint and gas pipeline should effect little change in subsistence-use patterns in Nelson Lagoon, Sand Point and Cold Bay due to the character of the harvest and the relative abundance of the resources available for harvest.

CONCLUSION (Effects on Subsistence-Use Patterns):

If there is a decision by NMFS to sharply reduce or suspend harvests of fur seals for a perod of 1 year or more, MAJOR adverse effects on subsistence-use patterns on the Pribilofs Islands could be realized. Elsewhere in the lease' area effects would be NEGLIGIBLE.

CUMULATIVE EFFECTS (Effects on Subsistence-Use Patterns):

Cumulative effects on subsistence-use patterns in Unalaska, Cold Bay, and on the Pribilof Islands and Alaska Peninsula are assessed as the aggregate result of current trends in the absence of the lease sale (Sec. IV.B.2., the No-Sale Alternative), the lease sale itself, and other activities or projects identified in Section IV.A.6.b. as constituting additional causal agents for potensubsistence resources and resulting subsistence-use patterns at Sand Point. Subsistence-use patterns at Sand Point also may be subject to change from the effects of increased population associated with increased activities at the terminal. Such effects could include more restrictive harvest regulations due to increased harvest pressure. At False Pass and King Cove, subsistence-use patterns likewise may be affected, but less by increased population than by the increased shuttle-canker traffic traveling through Unimak Pass to the terminal, to the extent comparable to the level of effect forecast for the terminal site.

Subsistence practices are intertwined with the traditional culture of the Aleut people that reside on the Pribilof Islands. As seen in the previous analysis, major effects on subsistence-use patterns would be realized if the fur seal population were jeopardized by effects or potential effects from oil spills. Since St. George Basin (Sale 70) exploration and Navarin Basin (Sale 83) development are included in the base case, the potential effects of the proposal for Sale 89 could be heightened with the development of hydrocarbon.s in the Sale 70 and Sale 92 (North Aleutian Basin) areas and with cankering from the Norton Basin and Barrow Arch areas to the north. The net effect could be not only a heightened risk to the fur seal population but potentially increased jeopardy to other subsistence resources used on the Pribilof Islands. This increased jeopardy would take place in the context of efforts to reconstitute the economy of the islands following federal withdrawal from sealing. During this time, subsistence harvests may be more important than ever before for the survival of the island's residents.

Conclusion (Effects on Subsistence-use Paterns): MAJOR effects on subsistence-use patterns could be realized on the Pribilof Islands. Effects on subsistence-cse patterns could be MINOR in Unalaska and NEGLIGIBLE in Cold Bay, although there could be MINOR effects among the other communities of the lower Alaska Peninsula.

(4) Effects on Local Economy:

Unalaska/Dutch Harbor: Employment effects would begin in 1986 with 21 additional jobs held by residents of the community and an additional 33 jobs held by workers expected to be housed in a petroleum industry enclave. The 21 new jobs held by community residents include jobs created by the indirect effects of the proposed sale, such as new jobs in retail trade or local government, as well as jobs in petroleum activities. The enclave workers would commute (i.e. rotate) to residences outside of Unalaska/Dutch Harbor and are expected tc spend equal numbers of days on the worksite and at their permanent residences elsewhere. Most commuters would maintain a permanent residence in Anchorage, in other Alaskan urban centers, or in communities outside of Alaska.. The 33 jobs held by commuters, together with the 21 additional jobs held by community residents, would increase total employment in 1986 from a projected 808 in the no-sale case to 862, for a gain of 7 percent above the no-sale case. See Table C-5 of Appendix C for annual projections of resident employment, enclave employment , and total employment, with and without the proposed lease sale.

The effect on employment would remain at less than 100 jobs until 1992, when total employment would be increased by 130 jobs, from 1,640 in the no-sale case to 1,770 as a result of the lease sale, for a projected gain of 8 percent. Peak-employment effect would occur in 1993, with 94 additional jobs held by the resident workforce and an additional 288 jobs held by commuters in the petroleum enclave. These additional jobs would increase total employment to 2,226 as compared to only 1,844 in the no-sale case, for a gain of 21 percent over the no-sale case. The percentage increase over the no-sale case would be even greater if total employment at Unalaska/Dutch Harbor were not expected to grow rapidly in the no-sale case during the years 1983-2000 due to expansion of the domestic-groundfish industry, By 1996, the total job effect of the proposed lease sale probably would decline to about 200 jobs. In most years subsequent to 1996, the increase in employment would be about 250 jobs, with virtually all of these jobs held by residents of the community. The increase of approximately 250 jobs would include jobs created by the indirect effects of the proposed lease sale, including new jobs in retail trade and local government. During the years subsequent to 1996, the sale would increase total employment by 8 or 9 percent above the employment projected in the no-sale case.

The general pattern is one of minor employment effects in the exploration phase and fairly significant effects during the development phase (peaking in 1993), with most jobs in both the exploration and development phases filled by commuters living in the petroleum enclave. By contrast, it is expected that the new jobs created by the production phase of the proposed lease sale would be filled entirely by permanent community residents. The production phase would begin in 1995, but would overlap with the development phase during the years 1995 and 1996.

Because unemployment is believed to be extremely low among permanent residents of Unalaska/Dutch Harbor, it is doubtful that the proposed lease sale would decrease joblessness in the community. However, because petroleum industry jobs generally pay well, it is possible that average incomes in the community would be increased slightly as a result of the lease sale. Possible negative economic effects could include crowding of port facilities, a slightly increased rate of price inflation, and housing shortages. Any effect on price levels probably would be limited to prices charged by hotels, restaurants, and bars, and to residential rental rates. Any damage which petroleum development might cause to the fish, fishing gear, or other marine resources of the region could result in economic loss to residents of the community. However, as explained in Section IV.B.1.b.(1.) (Effects on Commercial Fishing Industry), the overall effects on the commercial fishing industry are expected to be negligible.

Cold Bay: Employment effects would begin in 1986 with 3 additional jobs held by the resident workforce of Cold Bay and an additional 43 jobs held by workers expected to be housed in a petroleum industry enclave. The enclave workers would commute to residences outside of Cold Bay and are expected to spend equal numbers of days on the job at Cold Bay and at their permanent residences. Most commuters would maintain a permanent residence in Anchorage, in other urban centers of Alaska, or in communities outside of Alaska. The 43 new jobs held by commuters, together with the 3 additional jobs held by permanent residents, would increase total employment in 1986 from a projected 239 in the no-sale case to 285, for a gain of 19 percent above the no-sale case. See Table C-6 of Appendix C for annual projections of resident employment and enclave employment, and total employment, with and without the proposed lease sale.

Due to the many unknowns which will influence development in both the petroleum and groundfish industries, it is impossible to make reliable predictions of the relative effects of these two industries, or of the combined effects. The region has a past history of large scale ups and downs in economic activity, with activities in peak periods carried out largely by a transient workforce. This general pattern can be expected to persist into the indefinite future, regardless of the magnitude of future activities in the petroleum and groundfish industries. Heavy reliance on a transient workforce tends to reduce the effects of economic fluctuations on the permanent residents of the region.

Conclusion (effects on Local Economy): The cumulative effects of both the petroleum industry and the expansion of the domestic groundfish industry are expected to be MODERATE. The-principal economic effect probably would be a moderate decrease in joblessness among residents of the region, primarily among residents of the Pribilof Island communities of St. George and St. Paul.

(5) Effects on Community Infrastructure: The development scenario for the mean-resource level indicates that a primary air-support base could be at Cold Bay and a marine-support base could be based out of Unalaska/Dutch Harbor. St. George Island also could provide ❑arine and air support. The increased resident population generated by onshore activities of the above nature would be the major effect-causing agent that increases demand for and use of infrastructure. Severe adverse effects may occur when such infrastructure use exceeds a facility's capacity or an agency's ability to provide services. Expenditures necessary for public services and facilities generally rise in response to demand generated by economic and population growth. However, "although revenues generated from onshore OCS activities should be adequate to cover long-term expenditures, there could be a lag between the time that the demand for services arises and the tax revenues are sufficient to fund services. During this period, when revenues lag behind service demands, the community could experience hardships (i.e. , crowding of facilities , shortages of supply, and/or reduction of service standards).

The following discussions of the effects of OCS-related population growth on the capacities of existing and/or projected services in Cold Bay and Unalaska are based on the following assumptions: (1) industry would provide facilities and services for all employees residing in an enclave; only those employees becoming permanent residents of a community would use local infrastructure; and (2) industry would develop electrical and water-supply capacities to meet support-base functions. More detailed information concerning the projection of demand levels in the communities of Cold Bay and Unalaska can be found in Appendix G.

Most of the developable land on St. George Island is owned by the Tanaq Corporation, which has considerable political authority and could require the development of enclave-type facilities foz exploration-, development-, and production-support functions. Assuming that all facilities and services to meet the basic needs of enclave workers would be provided by industry , no expansion of St. George's infrastructure would be necessary. However, the community does envision expansion of basic services to support future fisheries and tourist ventures.

Cold Bay: If a commercial discovery Of oil were made, an OCS-generated population of 301 residents could be expected to reside in Cold Bay by the year 1997. Development of an air-support facility would provide additional strain on existing facilities, since the population in Cold Bay would more than double as a result of OCS activities. As a result, most local infrastructure would require expansion to meet community needs. The effects on individual services provided in Cold Bay due to population growth attributed to OCS activities are provided in the following discussions.

Housing should pose very few problems for the community. The removal of transportation and communication functions by RCA and the Federal Aviation Administration (FAA) would result in population reductions and a subsequent oversupply of housing. During the period of base-case population declines, OCS activities would result in a small influx of new residents. The OCS-generated demand for housing units would begin in 1986, reach a peak of about 120 units in 1997, and remain stable at this level over the rest of the forecast period. Until 1996, the oversupply of housing resulting from base-case population declines would be offset by the demand created by the influx of OCS residents. The potential uses of the available housing is uncertain; however, housing may be leased or rented to new residents. Land available for private development is currently limited. The City of Cold Bay is conducting negotiations with the State of Alaska and the U.S. Government in an effort to gain access to land. Analysts for the Bristol Bay Cooperative Management Plan Group project that the city would acquire about 1,000 acres of land by the end of the century (Impact Assessment, 1983). If these efforts are successful, adequate amounts of land would be available for residential purposes.

Student enrollment increases attributed to OCS activities would not be anticipated until the beginning of the production phase (1993-1994). During the exploration and development phases, most workers would be unattached or without dependents due to the short-term nature of Construction jobs. Little change is anticipated in the nature of educational service. in Cole Bay during this period. Enrollment increases of one student could be expected by 1992, with an increase of 43 students by 1997 and maintenance at this level (total enrollment 73 students) through the year 2004. After the year 2004, enrollment levels would decline slightly. During the years of peak OCS enrollments (1996-2005), total enrollment in Cold Bay's school systems is projected at about 73 students. The increased enrollment levels resulting from OCS activities would require expansion of Cold Bay's school system by 1997. To meet enrollment needs, one additional classroom would be necessary.

The current capacity of Cold Bay's generation system is 1,600 kilowatts (kW) which is over twice the current peak demand on the system. Assuming an installed generation capacity of 3.75 kW per resident (Alaska Consultants, 1981), a peak OCS-generated demand of 1,100 kW would occur between 1995 and 2900. Considering that the total demand would require an installed capacity of about 1,900 kW during this same period, the present generation system would not be able to accommodate the total resident population over the forecast period. OCS generated demand would account for over 50 percent of the total demand between 1995 and 2010.

The water- and sewage-treatment systems are currently overused for the current population levels. Because these systems are substandard and considering the current negotiations between the city and FAA, they would, in all likelihood, be expanded and improved within the next decade. The water-supply system with a capacity of .030 MGD should be adequate until the early 1990's. By 1995, the system's capacity would be exceeded as a result of domestic uses associated with OCS activities. OCS generated demands would peak at about .040 MGD between the years 2000 and 2010. This demand would account for over 60 percent of the total demand. With waste-water generation closely approximating water consumption, the sewage-treatment facility (design capacity 22,500 gallons/day) is operating beyond its capacity. A conservative estimate of present waste-water generation is 20,000 gallons/ day. The system could expect an increase in waste water ranging from 20,000 to 40,000 gallons per day between 1990 and 2010. OCS-related treatment loads would constitute over 60 percent of the total treatment load over the life of the project.

Cold Bay's health services would not undergo substantial changes, especially considering construction of the new health clinic in 1982. It is likely that health care would continue to be provided by a visiting public health nurse and visiting physician. Serious health-care needs would continue to be provided in Anchorage.

Police protection in Cold Bay is currently adequate; however, a full-time officer probably would be required due to the influx of OCS workers. Detention facilities also would require upgrading. Fire protection would be adequate in terms of equipment and storage capacity, but the system currently does not meet the standard of pumping 500 gallons per minute above normal water-flow conditions for a 2-hour period.

Unalaska: If a commercial discovery of oil were made, a maximum OCS-generated population of 441 residents could be anticipated in Unalaska by the year 2000. After the year 2000, the resident population would decline slightly to 3[illegible]0 residents in the year 2010. The effects on individual services provided in Unalaska due to population growth attributed to OCS activities are indicated in the following discussions.

Housing demands from OCS activities in Unalaska would peak at about 200 units in the late 1990's. This would constitute about 20 percent of the total housing demand.' Because of the small amount of land available for development, the increased demand for housing would be expected to fuel land speculation. This would manifest itself in higher prices for land purchase and house rental.

Facilities and staffing necessary to accommodate base-case population growth in the Unalaska school system should be able to absorb OCS-generated growth over the forecast period. Enrollment increases would begin in 1985 and increase to a peak of about 100 students between 1995 and 2005. Peak OCS-generated enrollment would constitute about 16 percent of the total enrollment in the system.

Improvements planned for Unalaska's utilities (power generation and water- and sewage-treatment systems) probably would be completed within the next 4 or 5 years. Even with the planned improvements, these systems may not be able to accommodate the increased demands. Improvements to the water- and sewage-treatment systems also could be delayed due to decreases in city revenues for public facilities. The demands on these services generated by OCS-resident populations would exacerbate the existing conditions associated with these systems; however, the demand increases would be minimal when compared to projected base-case-demand levels.

Citvplans indicate that the current power-generation system would be augmented in increments of 2,500 kW as demand warrants and that by 1990 power is expected to be supplied bv a geothermal or a heavy-fuel, low-speed diesel plant. Assuming these goals are achieved, OCS-residential power demands would have a negligible effect on the community's generation system. Installed capacity requirements for OCS-residential reeds could peak at about 1 ,700 kW around the year 2000. Assuming an installed capacity of 3.75 kW per resident, OCS residential needs would account for about 16 percent of the generation system's total capacity.

OCS companies operating out of Unalaska probably would generate their own power until the city develops a reliable central power system and thus would have little effect on the system. As OCS and fishing industries are phased into this system, if the system does not possess adequate peaking capacity, service-base demands could reduce power available to other users. In these instances, users would be required to generate power during peak-loading periods, thus increasing costs (Centaur Associates, Inc., 1983).

The economic growth expected in Unalaska over the next 30 years would considerablvincreasethe demand on the city's water system. Based on economic and population-growth figures, future average demand for industrial and nonindustrial purposes is expected to increase from current levels (11.5 MGD) to a peak of shout 23.5 MGD between 2000 and 2010. The majority of this growth is attributed to an expanded seafood-processing industry. Assuming that planned improvements to the system are completed and system leakage is reduced to near-zero, the present system (with a capacity of 17.3 MGD) would be adequate through the mid-1990's. OCS domestic demands would account for less than 1 percent of the total demand *over* the forecast period. The use of city water by OCS development companies is expected to be minimal. In the short term (exploration phase), fresh water could be obtained from tank trucks c?erated by industry. This system could easily be accommodated by the city. If commercial quantities of hydrocarbons are found, onshore developments could be serviced directly from city water liners. However, alternate developments (groundwater and/or surface runoff collection) are probable (Centaur Associates, Inc. 1983).

The effects of OCS activities on Unalaska's sewage-treatment system would be similar to those on the water-supply system, clue to the correlation between water and water consumption. Existing collection and treatment facilities are extremely inadequate and pose a health hazard to the community due to large quantities of sewage and waste being dumped into the waters around Unalaska. Increases in sewage and wastewater production from current levels to about .757 MGD by the year 2000 could aggravate existing problems; however, due to the small number of residents attributed to OCS activities, they would contribute about 10 percent of the total wastewater production.

Construction of support bases would not affect city wastewater-treatment facilities or the fishing industry. The Offshore Systems-facility operators have indicated that a septic tank and leach field would be built *to* handle OCS-workforce-generated wastes. Also, Captain's Bay, which is a potential support-kzse site, is far enough away from fishing industry activities {Iliuliuk Harbor) that any discharges would not interact with the seafood industry, which uses saltwater for processing (Centaur Associates, Inc. 1983) .

OCS activities would increase the local population and put an additional strain on health, police, and fire services. One additional acute-care hospital bed and one additional law enforcement officer would be necessary to meet the additional demand. In the long term, increased OCS activity would increase the availability of aircraft and vessels in the region to aid local emergency personnel in care and transportation of the injured.

CONCLUSION (Effects on Community Infrastructure):

Population increases resulting from an OCS marine-support base in Unalaska would have a MODERATE effect on all services and facilities except the water-supply system. Population increases associated with the development of an air-support base in Cold Bay would have a MAJOR effect on basic services.

CUMULATIVE EFFECTS (Effects on Community Infrastructure):

The cumulative effects on the infrastructure of Coid Bay and Unalaska are based on the assumption that (1) commercial quantities of hydrocarbon would be discovered and produced from the following planned OCS lease sales: Navarin Basin Lease Offering (April 1984), St. George Basin (Sale 89), and North Aleutian Basin (Sale 92); (2) exploration would occur only in the St. George Basin (Sale 70); (3) Cold Bay and Unalaska would serve as air- and marine-support bases, respectively, for the above-mentioned sales; and (4) base-case demands on these communities' infrastructures would be the same as outlined in Alternative II (Section IV.B.2.).

The development of other offshore lease areas in the Bering Sea and the state lease sale in Bristol Bay could substantially increase the resident populations and the demand for basic services in Cold Bay. A demand for *services* in addition to those necessary to provide for basic care and the population generated by the Navarin Basin (Sale 83) could severely hamper the communities' abilities to provide basic services, resulting in major effects.

The resident population of Unalaska is expected to increase from its current level (687 residents in 1981) to a peak of about 2,400 by the year 2000. The effects of this projected population trend on Unalaska's infrastructure would generally be the same as those outlined in the no-sale alternative (Sec. IV.B.2.). The demand for services would be slightly higher than those projected for the no-sale alternative (Alternative II); however, the projected population levels would still have MAJOR effects on Unalaska's infrastructure.

2. Alternative II - No Sale: The effects on biological resources and social and economic systems as described in the proposal (Alternative I or any of the alternatives to the proposal (Alternatives III, IV, V, and VI) would not occur in this alternative. The cancellation of this proposed lease sale could reduce future OCS oil and gas production, perpetuate the need for imported oil, and add to a national need to develop alternative energy sources. Appendix J identifies alternative energy sources and describes their environmental risks and current and projected uses. Table IV-12 shows the amount of energy needed from other sources to replace anticipated oil and gas production from the proposal.