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INDEXED BIBLIOGRAPHY OF NUCLEAR DESALINATION LITERATURE - 5

K. O. Johnsson

NUCLEAR DESALINATION INFORMATION CENTER

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NUCLEAR DESALINATION INFORMATION CENTER

**INDEXED BIBLIOGRAPHY OF
NUCLEAR DESALINATION LITERATURE — 5**

K. O. Johnsson

NUCLEAR DESALINATION PROGRAM

R. P. Hammond, Director

SEPTEMBER 1970

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee
operated by
UNION CARBIDE CORPORATION
for the
U.S. ATOMIC ENERGY COMMISSION

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The services of the Information Center include principally (1) preparation of bibliographies and abstracts in the field of nuclear desalination, (2) answering technical inquiries within the scope of the Center, (3) preparing specific information searches on request, and (4) publishing state-of-the-art reviews and survey reports. These services are available to U.S. Government agencies and their contractors, research and educational institutions, and industry.

Nearly all of the references listed in this bibliography are available in technical journals or are for sale by the U.S. Government Printing Office or the Clearinghouse for Federal Scientific and Technical Information. The Center is unable to furnish copies of any documents, but full size or microfiche copies of all documents listed are on hand at the Center and may be examined there by qualified personnel. Inquiries concerning the capabilities and operation of the Center may be addressed to:

K. O. Johnsson, Director
 (Phone 615/483-8611, Ext. 3-5473)
 Nuclear Desalination Information
 Center
 Oak Ridge National Laboratory
 P.O. Box Y, Building 9204-1
 Oak Ridge, Tennessee 37830

PREVIOUS REPORTS FROM THE CENTER

"Survey of the Use of Computer Programs for the Design of Desalination Evaporators and Their Coupling to Energy Sources," K. O. Johnsson, ORNL-NDIC-1 (October 1967).

"Abstracting and Indexing Guide for the Nuclear Desalination Information Center," K. O. Johnsson, ORNL-NDIC-2 (December 1967).

"Indexed Bibliography of Nuclear Desalination Literature - 1," NDIC Staff, ORNL-NDIC-3 (March 1968).

"Indexed Bibliography of Nuclear Desalination Literature - 2," NDIC Staff, ORNL-NDIC-4 (October 1968).

"Indexed Bibliography of Nuclear Desalination Literature - 3," K. O. Johnsson, ORNL-NDIC-5 (May 1969).

"Indexed Bibliography of Nuclear Desalination Literature - 4," K. O. Johnsson, ORNL-NDIC-6 (November 1969).

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INDEXED BIBLIOGRAPHY OF NUCLEAR DESALINATION LITERATURE - 5

ABSTRACT

Abstracts are given for approximately 210 published articles related to the desalination of seawater. The body of the report is a copy of information stored in a computerized storage and retrieval system for the Nuclear Desalination Information Center (NDIC) at the Oak Ridge National Laboratory. The abstracts are grouped in nine categories (and repeated if they fall into more than one category). An author and a keyword index to the articles referenced is provided. The keywords, which identify the content of the articles, were chosen from a thesaurus developed by NDIC.

INTRODUCTION

This indexed bibliography contains abstracts of desalination literature generally available to the public. It is the fifth such bibliography published by the Nuclear Desalination Information Center at the Oak Ridge National Laboratory. As more material is added to the Center's storage system, additional listings will be published.

The Nuclear Desalination Information Center was established in September 1966 under the sponsorship of the Division of Reactor Development and Technology of the U.S. Atomic Energy Commission as part of the Nuclear Desalination Program at the Oak Ridge National Laboratory. This program has the primary objectives of performing technical evaluation of various types of reactors for desalting plant applications, developing conceptual designs of reactors specifically for desalting applications, and developing components, systems, and technology for large-scale and prototype reactors optimized for coupling with seawater conversion plants.

The initial computer program and the system for abstracting and indexing were developed as a part of a seawater distillation literature survey conducted by ORNL for the Office of Saline Water, U.S. Department of Interior, in 1965. The Office of Saline Water continues to support the portion of the Center's information activities which deal with the distillation process. Consequently, abstracts on distillation processes will appear both here and in OSW compilations.

The bibliography list is divided into nine categories of desalination information; a single bibliographic entry may be listed in as many

as three categories. A keyword index and an author index are provided for the convenience of the user. Each bibliographic entry includes the following information: author(s), title, corporate author(s), number of pages, number of figures, number of references, publication date, document number or journal reference, an informative abstract of less than 200 words, and a list of selected keywords to describe the contents. The keywords are assigned by NDIC personnel to serve as coordinate indexing terms for storage and future retrieval of information. The most significant keyword terms for each bibliographic entry are indicated with an asterisk. The keywords are included with this bibliography since they can, through the keyword index, be of aid to the reader in locating related items of interest. Many readers, however, will prefer to scan the categories most closely related to their field of interest.

CATEGORIES

Nine subject categories have been established initially to organize information under specific areas of technology and interest. Since many reports cover information in more than one area, the abstracts for these reports will be found listed in two, or sometimes three, categories. Although categories have been established for several desalination processes, the distillation process is the only one specifically covered at the present time. The other processes may be included at some future date. Some reports may not appear, from the title, to be appropriate for inclusion here; however, they are included because information or data contained in the document was found to be of use in studies of some phase of nuclear desalination. The categories and their general coverage are:

10 ENERGY SOURCES

This category covers information on sources of energy under consideration for desalination plants. Primarily this will consist of reactor studies, but some other sources such as fossil fuels will be included when they are considered as alternatives to nuclear energy. In general, solar energy, geothermal energy, etc. are not included in the scope of the Center's activities.

20 ENERGY UTILIZATION (COUPLING)

This category covers information on the coupling of an energy source to a desalting plant. It includes the relationship between the design and economics of nuclear desalting plants as a function of the principal parameters. The evaluation of the various methods whereby nuclear dual-purpose plants can be designed and operated so as to provide the flexibility needed to adjust to various load conditions is included.

30 SEAWATER DISTILLATION PROCESSES

This category covers information on the various distillation processes, plants, and equipment (such as long-tube vertical evaporators, flash evaporators, and evaporator components). Also included are information related to materials of construction, heat transfer, fabrication methods, and design information useful in the development of distillation processes. (The basic chemical, physical, and thermodynamic data on seawater are listed under category 99.)

40 OTHER DESALTING PROCESSES

This category covers information on desalting processes other than distillation. These will include hyperfiltration, freeze process, ion exchange processes, etc. In general, this category is not in use at present; however, some entries will appear when they contain information which is of direct use for studies of the distillation process.

50 OVERALL PLANT STUDIES

This category covers studies on the overall or integrated desalting plant. This, in effect, is a combination of categories 10, 20, and 30 or 40. If the study is primarily on the design of a distillation process, it will be in category 30, even though an energy source may be specified to establish a basis for heat costs. However, if the design considers the effect of various heat sources and coupling parameters on the design, the information will be listed in category 50.

60 SITING CONSIDERATIONS

This category covers information on the factors involved in the choice of a site for a desalting plant. This includes the safeguards necessary due to the use of a nuclear energy source, construction problems because

CATEGORY 10 - ENERGY SOURCES

- 10-01094 COSENTINO JO + CSIK BJ + QUIHILLALT OA + SABATO JA
EXPERIENCE GAINED IN CONSTRUCTING ARGENTINAS NUCLEAR POWER STATION
COMISION NACIONAL DE ENERGIA ATOMICA, BUENOS AIRES, ARGENTINA
PREPRINT OF PAPER SM-126/1 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,
ISTANBUL, TURKEY, OCT.20-24,1969, 8 P
THE PLANNING AND CONSTRUCTION OF THE ATUCHA NUCLEAR POWER STATION, WHICH WILL GO INTO
OPERATION IN 1972, IS ANALYZED FROM THE ECONOMIC AND FINANCIAL POINT OF VIEW.
COMMENTS ARE MADE ON THE METHODS AND CRITERIA USED AND THE RESULTS OBTAINED IN THE
STAGES PRIOR TO STARTING THE WORK. DETAILS ARE GIVEN FOR THE INSTALLATION COST OF THE
STATION, THE CONTRIBUTION MADE BY ARGENTINE INDUSTRY AND THE EFFECT ON THE
TECHNOLOGICAL DEVELOPMENT OF THE COUNTRY. THE STATION WILL PRODUCE 319 MW(E) (NET) OF
POWER AND USES A NATURAL URANIUM, HEAVY WATER COOLED AND MODERATED REACTOR. THE TOTAL
COST IS ESTIMATED TO BE \$105,000,000 WHICH INCLUDES \$70,000,000 FOR CONSTRUCTION,
\$18,853,000 FOR HEAVY WATER, AND \$3,000,000 FOR URANIUM FUEL. (IN SPANISH)
*CONSTRUCTION COSTS + *DESIGN CRITERIA + *NUCLEAR ENERGY SOURCES + *PLANT CONSTRUCTION + ARGENTINA +
CONVERTER REACTORS + COST BREAKDOWNS + DESIGN + ECONOMIC EVALUATIONS + HEAVY-WATER REACTORS +
INTEREST + NUCLEAR DESIGN + 0-500 MW(E) REACTORS
- 10-01096 BARTH J
EXPECTED REDUCTIONS IN THE COST OF NUCLEAR STATIONS DUE TO THE EFFECT OF SERIAL PRODUCTION
ALSTHOM, PARIS, FRANCE
PREPRINT OF PAPER SM-126/3 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,
ISTANBUL, TURKEY, OCT.20-24,1969, 12 P
IN ORDER TO COMPETE EFFECTIVELY WITH CONVENTIONAL THERMAL PLANTS, THE BUILDERS OF
NUCLEAR POWER STATIONS HAVE HAD TO CHARGE, FROM THE VERY OUTSET, PRICES LOWER THAN THE
ACTUAL COST FOR THE FIRST ONE IN A SERIES, IN ANTICIPATION OF SELLING A CERTAIN NUMBER
OF FACILITIES OF THE SAME TYPE. AN EFFORT IS MADE TO DETERMINE THE EFFECT OF A SERIES
PRODUCED IN APPRECIABLY LARGER NUMBERS THAN ARE REGARDED AS CERTAIN TO BE SOLD. IN
PART 1 OF THE PAPER, A BREAKDOWN IS MADE OF THE TOTAL COST OF A NUCLEAR POWER STATION
INTO ITS MAIN COMPONENTS. IN PART 2 A REVIEW IS PRESENTED OF THE ELASTICITY OF COSTS
OF DIFFERENT COMPONENTS AS A FUNCTION OF THE NUMBER OF FACILITIES OF THE SAME TYPE
WHICH ARE PLANNED TO BE BUILT. PART 3 DISCUSSES TO WHAT EXTENT THE PRECEDING RULES
ARE APPLICABLE IN THE IMPORTANT CASE WHERE THE BUILDER HAS TO WORK IN COLLABORATION
WITH LOCAL INDUSTRY. (IN FRENCH)
*COMPONENT COSTS + *COST BREAKDOWNS + *NUCLEAR ENERGY SOURCES + ECONOMIC EVALUATIONS +
ENERGY SOURCES
- 10-01097 GALSSSENS J
CRITERIA OTHER THAN COST FACTORS FOR THE SELECTION OF NUCLEAR STATIONS
COMMISSARIAT A L ENERGIE ATOMIQUE, PARIS, FRANCE
PREPRINT OF PAPER SM-126/4 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,
ISTANBUL, TURKEY, OCT.20-24,1969, 13 P, 1 FIG, 1 REF
THESE CRITERIA ARE EITHER FINANCIAL (RATE OF INTEREST, FOREIGN TRADE) OR INDUSTRIAL
(POSSIBILITY OF LOCAL INDUSTRIES) OR ELSE THEY RELATE TO THE NECESSITY OF ASSURED FUEL
SUPPLIES OR PROMOTION OF SCIENTIFIC ACTIVITIES (PARTICIPATION IN DECISION MAKING
CONCERNING THE TYPE AND OPERATING CHARACTERISTICS OF NUCLEAR POWER STATIONS). THE
FIRST PART OF THE PAPER DEFINES THE ECONOMIC IMPORTANCE OF THESE CRITERIA FOR A GIVEN
COUNTRY. IN THE SECOND PART, REFERENCE IS MADE TO THE THEORY OF SELECTION IN USING
MULTIPLE CRITERIA. PARTICULAR EXAMPLES TAKEN FROM FRENCH EXPERIENCE ARE CITED. IN
THE THIRD PART, A BRIEF DESCRIPTION IS GIVEN OF A MODEL DECISION REGARDING CHOICES TO
BE MADE AT SOME UNKNOWN FUTURE DATE. THIS MODEL MAKES IT POSSIBLE TO TAKE DECISIONS
ON A RATIONAL BASIS, DESPITE THE TECHNICAL OR ECONOMIC UNCERTAINTIES, AFFECTING BOTH
POWER STATIONS AND THEIR ECONOMIC ENVIRONMENT (SHORT- AND LONG-TERM COSTS OF REACTORS
AND THEIR FUELLING, ETC.).
*ECONOMIC EVALUATIONS + *NUCLEAR ENERGY SOURCES + ENERGY SOURCES + INTEREST + INVESTMENT (FIXED) +
SITE SELECTION CRITERIA
- 10-01099 HAVARD J + THIRIET L
INFLUENCE OF LOCAL CONDITIONS ON THE INSTALLATION OF LOW-POWER NUCLEAR STATIONS
CENTRE D ETUDES NUCLEAIRES DE FONTENAY-AUX-ROSES, FRANCE
PREPRINT OF PAPER SM-126/7 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,
ISTANBUL, TURKEY, OCT.20-24,1969, 21 P, 3 REF
FACTORS INVOLVED IN THE DECISION TO USE NUCLEAR POWER SOURCES INCLUDE FUEL COSTS, MEANS
OF TRANSPORT, LEVEL OF INDUSTRIALIZATION, FOREIGN TRADE, INFLUENCE ON THE ECONOMIC
GROWTH OF THE COUNTRY, ETC. IN THE FIRST PART OF THE PAPER, THE AUTHORS DETERMINE THE
THRESHOLD ABOVE WHICH A NUCLEAR POWER STATION CAN BE COMPETITIVE, TAKING INTO ACCOUNT
ITS SIZE AND THE COST OF FOSSIL FUEL SUPPLIES. THE SECOND PART EXAMINES THE EFFECTS
OF LOCAL CONDITIONS ON THE DESIGN OF A NUCLEAR POWER STATION AND ITS MANAGEMENT. THE
THIRD PART DISCUSSES THE CRITERIA OF GENERAL INTEREST WHICH SHOULD BE TAKEN INTO
ACCOUNT IN CHOOSING THE TYPE OF POWER STATION AND THE ECONOMIC SIGNIFICANCE OF SUCH
CRITERIA. (IN FRENCH)
*ECONOMIC EVALUATIONS + *NUCLEAR ENERGY SOURCES + DESIGN + NUCLEAR FUEL CYCLE COSTS
- 10-01100 SCHLOSSER J + SCHRÖDER E
ECONOMICS OF HIGH TEMPERATURE REACTORS
BROWN BOVERI/KRUPP REAKTORBAU GMBH, MANNHEIM, GERMANY
PREPRINT OF PAPER SM-126/8 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,
ISTANBUL, TURKEY, OCT.20-24,1969, 19 P, 2 FIG, 5 REF
A SHORT DESCRIPTION IS PRESENTED OF THE TYPICAL DESIGN OF A COMMERCIAL HIGH TEMPERATURE
PEBBLE-BED REACTOR. THE MAIN COMPONENTS OF THE PRIMARY CIRCUIT ARE DISCUSSED AND
COMPARED WITH THOSE OF THE THORIUM HTR, A 300-MW(E) PROTOTYPE TO BE BUILT IN 1969.
EXPECTED TOTAL GENERATING COSTS ARE GIVEN. CAPITAL COSTS AS WELL AS FUEL CYCLE COSTS
ARE PRESENTED ON THE BASIS OF VARIOUS ECONOMIC GROUND RULES. FOR THE CAPITAL COSTS
ESPECIALLY, ECONOMY OF SIZE IS CONSIDERED. FUEL COSTS ARE BASED UPON BOTH THE URANIUM

ACCESSION NUMBER 10-01094 TO 10-01100

CATEGORY 10 - ENERGY SOURCES

10-01100 *CONTINUED*

AND THE THORIUM CYCLE. THEIR IMPLICATION FOR REFABRICATION FACILITIES, URANIUM AND SEPARATION WORK CONSUMPTION ARE DESCRIBED. THESE COSTS AND OTHER CHARACTERISTIC DATA OF THE HIGH TEMPERATURE REACTOR ARE COMPARED WITH THOSE TYPICAL OF THE LIGHT WATER REACTOR, SHOWING THE POTENTIAL OF THE HTR.

*ECONOMIC EVALUATIONS + *NUCLEAR ENERGY SOURCES + CAPITALIZED COSTS + CONVERTER REACTORS + DESIGN DATA + FUEL COSTS + GROUND RULES + HIGH-TEMPERATURE GAS-COOLED REACTORS + 0-500 MW(E) REACTORS + 500 PLUS MW(E) REACTORS

10-01121 MERLIN HB

ENERGY CONSUMPTION - ITS GROWTH AND PATTERN
ATOMIC ENERGY OF CANADA LTD., CHALK RIVER, ONT.
AECL-3293 (MAR.1969), 30 P, 15 FIG, 18 REF

PAST DEMANDS FOR ENERGY AND THE CONTRIBUTIONS BY THE MAJOR SOURCES ARE SHOWN FOR THE WORLD AND CANADA. THREE FORECASTS FOR FUTURE DEMANDS ARE PRESENTED. WORLD PRODUCTION OF ELECTRICITY IN NUCLEAR STATIONS BY THE YEAR 2000 WILL BE ALMOST THREE TIMES THE ELECTRICITY PRODUCED IN THE WORLD TODAY. THE AMOUNT OF FUEL CONSUMED IN GENERATING THIS ELECTRICITY WILL DEPEND UPON THE TYPES AND MIX OF REACTORS INSTALLED. THE HEAVY WATER REACTORS ALONE OR IN CONJUNCTION WITH FAST BREEDERS AND LIQUID FUELED REACTORS ARE THE MOST EFFICIENT USERS OF URANIUM AND THORIUM RESOURCES. HEAVY WATER REACTORS ARE THE MOST EFFICIENT PRODUCERS OF PLUTONIUM. WORLD, REGIONAL AND CANADIAN FORECASTS ARE GIVEN FOR TOTAL ELECTRICITY GENERATED AND FOR ELECTRICITY GENERATED IN NUCLEAR STATIONS.

*ENERGY SOURCES + BREEDER REACTORS + ENERGY COSTS + FOSSIL FUELS + HEAVY-WATER/ORGANIC-COOLED REACTORS + NUCLEAR ENERGY SOURCES

10-01132 ONAGA Y + OOMACHI S

NUCLEAR ENERGY COSTS IN JAPAN - PRESENT AND NEAR FUTURE
MINISTRY OF INTERNATIONAL TRADE AND INDUSTRY, TOKYO, JAPAN
PREPRINT OF PAPER SM-126/11 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT. 20-24, 1969, 16 P, 2 FIG

ONE 166 MWE NUCLEAR POWER PLANT IS OPERATING IN JAPAN, AND 5 UNITS TOTALING 2406 MWE ARE UNDER CONSTRUCTION. IT IS EXPECTED THAT THE TOTAL NUCLEAR POWER GENERATING CAPACITY WILL BE ABOUT 40,000 MWE BY 1985. THE ONE PLANT NOW OPERATING IS NOT ECONOMIC IN THE NORMAL SENSE BECAUSE OF ITS R+D CHARACTERISTICS AS THE FIRST COMMERCIAL-SCALE NUCLEAR PLANT. BUT ESTIMATED POWER COSTS FOR THE PLANTS UNDER CONSTRUCTION ARE IN THE 6- TO 7-MILL RANGE, AND IT IS EXPECTED THAT THE NUCLEAR POWER COSTS WILL SOON BE COMPETITIVE WITH THOSE OF OIL-FIRED PLANTS. BECAUSE OF LOCAL INTEREST RATES, VARIOUS RESTRICTIONS ON PLANT LOCATION, AND DEPRECIATION METHODS, THE COST OF NUCLEAR POWER IN JAPAN DIFFERS CONSIDERABLY FROM OTHER COUNTRIES. AN ECONOMIC EVALUATION OF NUCLEAR POWER IN JAPAN MUST ALSO TAKE INTO ACCOUNT FUTURE TECHNOLOGICAL PROGRESS, REDUCTION OF CONSTRUCTION COSTS DUE TO INCREASES IN SIZE OF PLANTS, AND THE TREND OF FUEL CYCLE COSTS. THIS PAPER DEFINES THESE VARIOUS FACTORS INFLUENCING THE COSTS OF NUCLEAR POWER STATIONS IN OPERATION OR UNDER CONSTRUCTION AND ATTEMPTS TO RESOLVE FUTURE PROBLEMS WHICH WILL ARISE IN CONNECTION WITH COST ESTIMATES OF NUCLEAR POWER.

*ENERGY COSTS + *NUCLEAR ENERGY SOURCES + BOILING-WATER REACTORS + ECONOMIC CONDITIONS + ECONOMIC EVALUATIONS + JAPAN + NUCLEAR FUEL CYCLE COSTS + PRESSURIZED-WATER REACTORS + 0-500 MW(E) REACTORS + 500 PLUS MW(E) REACTORS

10-01134 KIKUCHI T

LONG-TERM NUCLEAR FUEL CYCLE AND ITS ECONOMICS RELATING TO PLUTONIUM UTILIZATION
ATOMIC ENERGY BUREAU, TOKYO
PREPRINT OF PAPER SM-126/12 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT. 20-24, 1969, 33 P, 15 FIG

AN EVALUATION BY SYSTEMS ANALYSIS OF THE EFFECT OF PLUTONIUM UTILIZATION ON THE NUCLEAR FUEL CYCLE AND ITS ECONOMICS. THE CALCULATION MODEL DEVELOPED HERE CAN BE USED FOR THE FOLLOWING STUDIES - (1) PLUTONIUM THERMAL USE UP TO THE INTRODUCTION OF THE FAST BREEDER REACTOR INTO THE NUCLEAR POWER GENERATING SYSTEM, (2) SUCCESSFUL DEVELOPMENT OF PLUTONIUM SELF-SUSTAINING-TYPE REACTORS, (3) PLUTONIUM IMPORTING, AND (4) INTRODUCTION OF URANIUM-LOADING FBRS DUE TO PLUTONIUM DEFICIENCY AFTER THE INCLUSION OF FBRS IN THE NUCLEAR POWER SYSTEM.

*ECONOMIC EVALUATIONS + *NUCLEAR FUEL CYCLE COSTS + ENERGY COSTS + ENERGY SOURCES + NUCLEAR ENERGY SOURCES

10-01135 TAKEI M + SUZUKI S + WATANABE H

EVALUATION OF THE GROWTH OF NUCLEAR POWER IN THE FUTURE POWER SYSTEM
INSTITUTE OF ENERGY ECONOMICS, TOKYO
PREPRINT OF PAPER SM-126/13 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT. 20-24, 1969, 23 P, 9 FIG

THE INTRODUCTION OF NUCLEAR POWER PLANTS INTO A POWER SYSTEM IS DETERMINED BY THE TECHNO-ECONOMIC CONDITIONS WITHIN THE WHOLE ELECTRICAL ECONOMY. THEIR FUTURE CAPACITIES ARE DETERMINED BY ECONOMIC COMPETITION WITH CONVENTIONAL POWER PLANTS, ATTAINING THE OPTIMUM COMBINATION OF ELECTRICAL POWER EQUIPMENT. THE COMBINATION OF NUCLEAR POWER REACTORS IS ALSO THE RESULT OF ECONOMIC COMPETITION BETWEEN MANY TYPES OF REACTORS DIVIDING THE SHARE OF NUCLEAR POWER IN THE TOTAL SYSTEM. BASED ON THESE CONCEPTS, A SIMPLIFIED OPTIMIZATION MODEL WAS DEVELOPED, USING THE TWO SPECIFIED VARIABLES OF THE LOAD DURATION CURVE AND THE POWER COSTS OF THE ELECTRICAL EQUIPMENT. THE PERFORMANCE OF THIS MODEL IS DISCUSSED ON THE BASIS OF - (1) DETERMINATION OF OPTIMUM COMBINATION OF ELECTRICAL POWER EQUIPMENT INCLUDING NUCLEAR POWER, (2) SIMULATION ANALYSIS OF NUCLEAR POWER CAPACITIES FROM 1970 TO 2000 WITH VARIOUS ASSUMPTIONS FOR NUCLEAR POWER COSTS AND FOSSIL FUEL PRICES, (3) EFFECTS OF FUTURE MODIFICATION OF THE LOAD DURATION CURVE UPON NUCLEAR POWER CAPACITIES.

*ECONOMIC EVALUATIONS + *NUCLEAR ENERGY SOURCES + *SYSTEMS ENGINEERING + ECONOMIC CONDITIONS +

CATEGORY 10 - ENERGY SOURCES

10-01135 *CONTINUED*
ENERGY SOURCES + JAPAN + LOAD FACTOR

10-01136 WRIGHT JH
COST EXPERIENCE AND TRENDS IN THE COST OF PRESSURIZED WATER REACTORS
WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.
PREPRINT OF PAPER SM-126/14 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,
ISTANBUL, TURKEY, OCT. 20-24, 1969, 6 P, 7 TABLES, 3 FIG
FACTORS AFFECTING THE COST OF NUCLEAR PLANTS, SUCH AS EQUIPMENT ENGINEERING, CRAFT
LABOR, SCHEDULE AND ESCALATION, ARE EXAMINED IN DETAIL AND COMPARED WITH CURRENT
EXPERIENCE ON FOSSIL PLANTS. WIDE VARIATIONS IN PLANT COSTS ARE BEING EXPERIENCED
FROM ONE LOCATION TO ANOTHER, LARGELY AS A RESULT OF CRAFT LABOR RATES AND
PRODUCTIVITY. THIS STUDY REVEALS THAT THE NUCLEAR PLANT COST PROBLEMS, COMPARED TO
FOSSIL PLANTS, ARE LARGELY ASSOCIATED WITH THE LONGER SCHEDULE FOR NUCLEAR PLANTS.
THE FIELD LABOR CONTENT IS ACTUALLY SMALLER FOR A NUCLEAR PLANT DUE TO ITS MUCH HIGHER
SHOP FABRICATION CONTENT. INFLATIONARY FACTORS ARE ALSO APPLIED TO NUCLEAR AND FOSSIL
FUEL COSTS TO SHOW THE SIGNIFICANCE OF THE TOTAL EFFECT. RESULTS OF PRESENT
EXPERIENCES AND TRENDS SUGGEST THAT COMPETITION BETWEEN NUCLEAR AND FOSSIL POWER
PLANTS WILL CONTINUE TO BE VIGOROUS IN THE YEARS AHEAD.
*COST ALLOCATION + *NUCLEAR ENERGY SOURCES + *PRESSURIZED-WATER REACTORS + ECONOMIC CONDITIONS +
ECONOMIC EVALUATIONS + ENERGY SOURCES

10-01137 ODCNELL AJ + LICCIARDO RBA
NUCLEAR POWER - A BASIS FOR REGIONAL ECONOMIC DEVELOPMENT
BECHTEL CORP., SAN FRANCISCO, CALIF.
PREPRINT OF PAPER SM-126/15 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,
ISTANBUL, TURKEY, OCT. 20-24, 1969, 8 P, 20 FIG
THE SIX NATIONS OF THE WESTERN PACIFIC BASIN (NEW ZEALAND, AUSTRALIA, PHILIPPINES,
TAIWAN, SOUTH KOREA, AND JAPAN) WERE SELECTED FOR DEMONSTRATION OF AN INTEGRATED
NUCLEAR FUEL COMPLEX ON A MULTINATIONAL REGIONAL BASIS, WHEREBY THEY WOULD POOL THEIR
INTERESTS FOR FINANCING, CONSTRUCTION, AND OPERATION OF THE SEVERAL PROCESS OPERATIONS
REQUIRED TO SUPPORT THEIR NUCLEAR POWER INSTALLATIONS. IT APPEARS THESE COUNTRIES
WOULD NOT HAVE TO DEPEND ON OUTSIDE NUCLEAR FUEL CYCLE SERVICES BEYOND 1975, WITH THE
POSSIBLE EXCEPTION OF ENRICHMENT FACILITIES. BY 1980 ABOUT 30,000 MWE WILL BE
GENERATED BY NUCLEAR POWER STATIONS PLANNED BY THE SIX COUNTRIES. NUCLEAR FUEL
REQUIREMENTS FOR THIS CAPACITY WOULD REQUIRE INVESTMENT OF ABOUT \$700 MILLION IN
FACILITIES FOR CONVERSION OF URANIUM OXIDE TO URANIUM HEXAFLUORIDE, FOR ENRICHMENT,
FOR FUEL FABRICATION AND FUEL REPROCESSING. ANNUAL OPERATING COSTS WILL BE ABOUT \$350
MILLION. WITH THE EXCEPTION OF JAPAN, THESE COUNTRIES WOULD BE UNABLE TO SUPPORT
INDIVIDUAL NUCLEAR FUEL CYCLE FACILITIES TO MEET THEIR OWN NATIONAL NEEDS AT THAT
TIME. THE ECONOMIC, INDUSTRIAL DEVELOPMENT, AND EMPLOYMENT OPPORTUNITIES OF THE
INTEGRATED, COOPERATIVE CONCEPT SEEM TO OFFER SUBSTANTIAL INCENTIVES TO THESE AND
OTHER REGIONS OF THE WORLD WHERE THIS CONCEPT IS FEASIBLE.
*NUCLEAR ENERGY SOURCES + CAPITALIZED COSTS + CONSTRUCTION COSTS + ENERGY SOURCES + FUEL COSTS +
NUCLEAR FUEL PROCESSING STUDIES + OPERATING COSTS

10-01143 UNAL HC
ECONOMIC ASPECTS OF NUCLEAR POWER IN TURKEY
CEKMECE NUCLEAR RESEARCH AND TRAINING CENTER, ISTANBUL
PREPRINT OF PAPER SM-126/16 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,
ISTANBUL, TURKEY, OCT. 20-24, 1969, 15 P, 6 FIG, 17 TABLES, 15 REF
THIS PAPER OUTLINES TURKEY'S ENERGY RESOURCES, THE PAST, PRESENT AND FUTURE ELECTRIC
POWER SITUATION AND THE HYDRO AND THERMAL POWER PLANT PROJECTS PLANNED BY THE STATE
PLANNING DEPARTMENT TO BE BUILT POSSIBLY DURING THE SECOND OR THIRD FIVE-YEAR PLANS
(1967-1972, 1972-1977, RESPECTIVELY). AN ECONOMIC COMPARISON OF THE PLANNED POWER
PLANTS WITH THE 300, 400, 500 AND 400 MWE BWR AND PHWR TYPE NUCLEAR POWER PLANTS IS
MADE ON THE BASIS OF THE UNIT ENERGY COST. THE RESULTS INDICATE THAT THE COST OF
NUCLEAR POWER WILL BE COMPARABLE WITH THE COST OF HYDRO POWER AND CHEAPER THAN
CONVENTIONAL THERMAL POWER FOR THE NEXT DECADE IN TURKEY. IT IS ANTICIPATED THAT THE
FIRST NUCLEAR POWER STATION WILL BE GENERATING ELECTRICITY BY 1977.
*ENERGY SOURCES + *NUCLEAR ENERGY SOURCES + *POWER GROWTH SURVEYS + ECONOMIC CONDITIONS +
ECONOMIC EVALUATIONS + ENERGY COSTS + TURKEY

10-01144 AYBERS N
SHORT-TERM PROSPECTS FOR CONVENTIONAL AND NUCLEAR POWER GENERATION COSTS IN TURKEY
TECHNICAL UNIVERSITY OF ISTANBUL, TURKEY
PREPRINT OF PAPER SM-126/17 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,
ISTANBUL, TURKEY, OCT. 20-24, 1969, 24 P, 1 FIG, 13 REF
POWER AND ENERGY FORECASTS, AS WELL AS THE PRESENT POWER SITUATION IN TURKEY, ARE
EXAMINED. INDICATIONS ARE THAT, DESPITE COMPLETION OF HYDRAULIC AND THERMAL PLANTS
NOW IN THE PLANNING STAGE, TURKEY WILL HAVE AN ENERGY AND POWER DEFICIT AFTER 1982.
IT APPEARS ECONOMICALLY FEASIBLE TO USE MEDIUM-SIZE NUCLEAR POWER PLANTS TO MEET THE
TEMPORARY ENERGY DEFICIT UNTIL OTHER LARGE HYDROELECTRIC PLANTS CAN BE PUT INTO
OPERATION. THUS IT IS ANTICIPATED THAT A 300- OR 400-MWE NUCLEAR PLANT WILL BE
OPERATIONAL IN 1976 OR 1977, AND AN ADDITIONAL NUCLEAR POWER STATION OF ABOUT 1200 MWE
CAPACITY WILL BE NECESSARY BETWEEN 1982 AND 1987. FOR COMPARISON, SHORT-TERM
PROSPECTS FOR CONVENTIONAL GENERATION COSTS ARE EXAMINED. ENERGY COSTS AT THE 300-MW
SEYITOMER LIGNITE-BURNING POWER PLANT AND AT THE 300-MW FUEL-OIL-FIRED AMBARLI PLANT
ARE ESTIMATED. THE 350-MWE CANOU-PHY POWER STATION IS USED AS THE NUCLEAR REFERENCE
PLANT IN THIS COMPARISON. CAPITAL COSTS, AS WELL AS ALL OTHER COSTS INCURRED IN
BRINGING THE STATION UP TO POWER, ARE ESTIMATED. THE INFLUENCE OF LOCAL CONDITIONS IN
TURKEY ON UNIT CAPITAL COST AND ON UNIT ENERGY COST ARE SHOWN, AND THE EXPECTED COST
OF ENERGY FOR THE FIRST NUCLEAR POWER STATION IN TURKEY IS ESTIMATED.
*COST BREAKDOWNS + *ENERGY SOURCES + CAPITALIZED COSTS + ECONOMIC CONDITIONS +

ACCESSION NUMBER 10-01135 TO 10-01144

CATEGORY 10 - ENERGY SOURCES

10-01144 *CONTINUED*

ECONOMIC EVALUATIONS + NUCLEAR ENERGY SOURCES + TURKEY

10-01145 DINCLER G + BOBLETER O + KOCAKUSAK O
ECONOMIC ASPECTS OF NUCLEAR FUEL FABRICATION AND REPROCESSING IN TURKEY
MIDDLE EAST TECHNICAL UNIVERSITY, ANKARA, TURKEY

PREPRINT OF PAPER SM-126/18 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,
ISTANBUL, TURKEY, OCT. 20-24, 1969, 19 P, 6 FIG, 18 REF

A COMPARISON OF HYDRO, THERMAL, AND NUCLEAR POWER COSTS AND CAPACITIES IN TURKEY UP TO YEAR 2000 IS PRESENTED. PLANS ARE DISCUSSED FOR INCLUDING LARGE RESERVES OF RECENTLY FOUND, LOW-ENERGY LIGNITE IN THE INTERCONNECTED ENERGY SYSTEM OF TURKEY. TIMING AND PLANNED GROWTH OF NUCLEAR POWER NEEDS IN TURKEY ARE DISCUSSED. FUEL MANUFACTURE FOR VARIOUS REACTOR TYPES AND PROBLEMS OF REPROCESSING FUEL ELEMENTS ARE CONSIDERED, TAKING LOCAL CONDITIONS INTO ACCOUNT. TURKISH URANIUM RESERVES AND THEIR ECONOMICS ARE BRIEFLY DISCUSSED. ACTUAL AND PLANNED ENERGY NEEDS FOR THE PERIOD 1961-1982, ESPECIALLY BY CHEMICAL INDUSTRIES, ARE DIAGRAMMED, WITH ENERGY REQUIREMENTS TO YEAR 2000 EXTRAPOLATED. PROBLEMS OF TRANSPORTATION OF URANIUM ORES TO FUEL MANUFACTURING PLANTS AND OF USED FUEL TO THE REPROCESSING FACTORY ARE EXPLORED, AND A SCHEMATIC MAP IS PRESENTED SHOWING ASSUMED LOCATION OF NUCLEAR ENERGY PLANTS, FUEL MANUFACTURE AND REPROCESSING PLANTS, AND ENERGY LINES OVER THE COUNTRY. THE CAPACITY OF THE REPROCESSING PLANT IS EVALUATED ON THE BASIS OF PLANS FOR THE INCREASE OF NUCLEAR ENERGY PRODUCTION.

*ECONOMIC EVALUATIONS + *ENERGY SOURCES + *FUEL COSTS + *NUCLEAR FUEL CYCLE COSTS + ECONOMIC CONDITIONS + NUCLEAR ENERGY SOURCES + TURKEY

10-01146 MANDIC D + MOJOVIC L

ANALYSIS OF THE CONDITIONS AFFECTING THE INTRODUCTION OF NUCLEAR POWER PLANTS INTO YUGOSLAVIAS
ELECTRIC POWER SYSTEM IN THE COMING DECADES
ENERGOPROJEKT, BEOGRAD, YUGOSLAVIA

PREPRINT OF PAPER SM-126/19 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,
ISTANBUL, TURKEY, OCT. 20-24, 1969, 14 P, 2 FIG, 4 REF

A LONG-TERM PREDICTION OF POWER CONSUMPTION AND UTILIZATION OF HYDRO POWER POTENTIAL, BASED ON DEVELOPMENT OF THE ELECTRICAL POWER INDUSTRY IN THE PAST DECADE AND PLANNED GROWTH FOR THE NEXT FEW YEARS, IS PRESENTED. AN OPTIMIZATION PROCEDURE DEVELOPED FOR ANALYSIS OF A SYSTEM WITH APPRECIABLE HYDRO POWER GENERATION IS APPLIED TO DETERMINE CONDITIONS FOR COMPETITIVE INTRODUCTION OF NUCLEAR PLANTS. PRESENT WORTH OF COSTS IS USED AS THE ECONOMIC CRITERION THROUGHOUT THE COUNTRY. FOR PREDICTED FUTURE COST OF LIGNITE AND NUCLEAR FUEL, THE PROCEDURE GIVES THE UPPER LIMIT OF INVESTMENTS IN NUCLEAR PLANTS RELATIVE TO INVESTMENTS IN LIGNITE-FIRED PLANTS, WHICH MAKES THE NUCLEAR PLANT COMPETITIVE. THE LOAD FACTOR FOR THERMAL AND NUCLEAR PLANTS IS ALSO INDICATED AND THE NUCLEAR FUEL CYCLE POLICY IS EXPLORED. FOR LIGHT- AND HEAVY-WATER REACTORS, THE PAPER INDICATES URANIUM REQUIREMENTS, PLUTONIUM PRODUCTION, CAPACITIES IN FUEL INDUSTRY WHICH MIGHT BE JUSTIFIED IN THE COUNTRY, AND FOREIGN CURRENCY EXPENDITURE INCURRED BY THE ASSESSED NUCLEAR PROGRAM. THE STUDY IS CONFINED TO AN OVERALL PICTURE AND DOES NOT TAKE INTO ACCOUNT THE CONDITIONS FOR PARTICULAR REGIONS WITHIN THE COUNTRY.

*ENERGY SOURCES + *NUCLEAR ENERGY SOURCES + *NUCLEAR FUEL CYCLE COSTS + ECONOMIC CONDITIONS + ECONOMIC EVALUATIONS + YUGOSLAVIA

10-01148 IYER PA + CHU C

SUBMERGED COMBUSTION

ENGINEERING DEPT., UNIV. CALIF., LOS ANGELES

REPT. 70-8, UCLA ENG. DEPT. (JAN.1970), 16 P, 6 TABLES, 2 FIG, 13 REF

SUBMERGED COMBUSTION CAN BE USED ADVANTAGEOUSLY TO HEAT AND EVAPORATE SALINE WATER AND TO CONCENTRATE OTHER CORROSIVE AND SCALE FORMING LIQUIDS. THE PRINCIPAL ADVANTAGE LIES IN THE HIGH EVAPORATION AND COMBUSTION EFFICIENCIES OBTAINED. THIS WORK INVESTIGATES THE EFFECTS OF PERCENTAGE EXCESS AIR, TOTAL GAS FLOW RATE AND SUBMERGENCE ON THESE EFFICIENCIES. AN INCREASE IN PERCENTAGE EXCESS AIR TENDS TO IMPROVE BOTH THE EVAPORATION AND COMBUSTION EFFICIENCIES. AN INCREASE IN TOTAL GAS FLOW RATE INCREASES THE EVAPORATION EFFICIENCY BUT DECREASES COMBUSTION EFFICIENCY. SUBMERGENCE HAS A SLIGHTLY NEGATIVE EFFECT ON EVAPORATION EFFICIENCY BUT NO SIGNIFICANT EFFECT ON COMBUSTION EFFICIENCY, IN THE SHORT RANGE USED IN THIS WORK.

*DIRECT CONTACT HEAT EXCHANGE + DISTILLATION PROCESSES + ENERGY SOURCES + HEAT TRANSFER

10-01149 LEPECKI WPS

THE INFLUENCE OF NUCLEAR ENERGY ON THE DEVELOPMENT OF BRAZIL

INSTITUTE DE PESQUISAS RADIOACTIVAS, BELO HORIZONTE, BRAZIL

PREPRINT OF PAPER SM-126/24 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,
ISTANBUL, TURKEY, OCT. 20-24, 1969, 11 P, 5 TABLES, 5 FIG, 12 REF

A SURVEY OF NUCLEAR ENERGY REQUIREMENTS IN BRAZIL WAS MADE, AND IT INDICATES THAT ABOUT 1000 MW OF NUCLEAR POWER GENERATING CAPACITY WILL NEED TO BE ADDED EACH YEAR FOR THE NEXT 30 YEARS IN THE SOUTHCENTRAL REGION ALONE (THE MOST DEVELOPED REGION OF THE COUNTRY). BASED ON THESE FORECASTS, AN ESTIMATE IS MADE OF INDUSTRIAL REQUIREMENTS IN SEVERAL AREAS - MINING, FUEL ELEMENT FABRICATION, AND PLANT EQUIPMENT PROPER. A SURVEY OF THE IMPACT OF THE NUCLEAR PROGRAM ON THE GENERAL TECHNOLOGICAL AND SCIENTIFIC RESEARCH LEVEL AND ON THE ECONOMY AS A WHOLE WAS MADE, INDICATING THAT YEARLY EXPENDITURES IN THE NUCLEAR PROGRAM WILL RISE FROM ABOUT \$60 MILLION PER YEAR IN 1975-80 TO MORE THAN \$1,000 MILLION PER YEAR IN 1995-2000.

*ECONOMIC CONDITIONS + *NUCLEAR ENERGY SOURCES + BRAZIL + ENERGY SOURCES

10-01151 BOETTCHER A + KRAMER H + WAGEMANN K

PROSPECTS OF NUCLEAR ENERGY IN COUNTRIES WITH RESTRICTED CAPITAL AND FOREIGN CURRENCY AVAILABILITY
KERNFORSCHUNGSANLAGE JULICH GMBH, GERMANY

PREPRINT OF PAPER SM-126/26 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,

ACCESSION NUMBER 10-01144 TO 10-01151

CATEGORY 10 - ENERGY SOURCES

10-01151 *CONTINUED*

ISTANBUL, TURKEY, OCT. 20-24, 1969, 8 P, 7 FIG, 4 TABLES, 6 REF

IN RECENT YEARS OPTIMIZATION MODELS HAVE BEEN DEVELOPED TO DETERMINE FOR DIFFERENT POWER PLANTS THE CAPACITY DISTRIBUTION LEADING TO CHEAPEST POWER GENERATING COSTS IN AN EXPANDING POWER GRID. IN SUCH STRATEGY CALCULATIONS FOR RAPIDLY DEVELOPING COUNTRIES OTHER OPTIMIZATION CRITERIA MAY ALSO BE OF INTEREST. IN ADDITION TO MINIMIZATION OF OVERALL POWER GENERATING COST, MINIMUM CAPITAL AND FOREIGN CURRENCY REQUIREMENTS OVER A LONG PERIOD MAY BE VITAL TO THE STUDY. IN THIS PAPER SUCH CALCULATIONS HAVE BEEN CARRIED OUT FOR A GIVEN POWER GRID AND, FROM THESE VIEWPOINTS, DIFFERENT COMBINATIONS OF NUCLEAR POWER PLANTS ARE CONSIDERED. RELATIONSHIPS BETWEEN SAVINGS IN CAPITAL AND FOREIGN CURRENCY REQUIREMENTS ON THE ONE SIDE AND INCREASE IN POWER GENERATING COSTS ARE PRESENTED AND CORRELATED WITH THE NECESSARY CAPACITY OF THE RESPECTIVE FUEL CYCLE INDUSTRY. IT IS CONCLUDED FROM THE RESULTS THAT HWRS (WITH NATURAL URANIUM AS WELL AS WITH PU-RECYCLE) AND HTRS MAY PLAY A SIGNIFICANT ROLE FOR SUCH COUNTRIES.

*CAPITAL + *NUCLEAR ENERGY SOURCES + ENERGY SOURCES + HEAVY-WATER REACTORS

10-01152 HUNDT D

FUTURE TRENDS IN FUEL CYCLE COST FOR MEDIUM-SIZE LIGHT WATER REACTORS

AEG - TELEFUNKEN, FRANKFURT, WEST GERMANY

PREPRINT OF PAPER SM-126/27 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT. 20-24, 1969, 14 P, 9 FIG, 11 REF

THE VARIOUS PHASES OF THE FUEL CYCLE (URANIUM CONCENTRATE EXTRACTION, PLUTONIUM, CONVERSION, ENRICHMENT, FUEL ASSEMBLY FABRICATION, AND REPROCESSING) ARE EXAMINED FROM AN ECONOMIC VIEWPOINT, AND THE INFLUENCE OF COST CHANGES IN THE VARIOUS PHASES ON THE TOTAL FUEL CYCLE COSTS OF A 400 MWE LIGHT WATER REACTOR IS CALCULATED. REDUCTION OF FUEL CYCLE COSTS OVER THE LAST DECADE AS A RESULT OF IMPROVED CORE DESIGN IS DISCUSSED. THE RESULT OF THIS ESTIMATION SHOWS THAT EVEN WITHOUT TAKING CREDIT OF FURTHER IMPROVEMENTS IN THE DESIGN OF LIGHT WATER REACTORS AN INCREASE OF URANIUM PRICES OF ABOUT 30% WILL NOT RESULT IN HIGHER FUEL CYCLE COSTS BECAUSE OF COST REDUCTIONS FORECAST FOR OTHER PHASES OF THE CYCLE DUE TO HIGHER FABRICATION QUANTITIES. AT A FIXED CHARGE RATE OF 8%, FUEL CYCLE COSTS ARE ESTIMATED AT 1.58 MILLS/KWH.

*BOILING-WATER REACTORS + *NUCLEAR FUEL CYCLE COSTS + ECONOMIC EVALUATIONS + ENERGY COSTS + ENERGY SOURCES + FUEL COSTS + NUCLEAR ENERGY SOURCES + NUCLEAR FUEL PROCESSING STUDIES + 0-500 MW(E) REACTORS

10-01153 GOLDSMITH K

SOME ASPECTS OF POWER SYSTEM EXPANSION IN DEVELOPING COUNTRIES

ELECTRO-WATT ENGINEERING SERVICES LTD., ZURICH

PREPRINT OF PAPER SM-126/28 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT. 20-24, 1969, 12 P, 2 FIG

A DISCUSSION OF THE FACTORS COMPRISING THE POWER MARKET AND THE GENERATING PLANTS NECESSARY TO SUPPLY THE MARKET. PARTICULAR ATTENTION IS GIVEN TO DEMAND PATTERNS, INTEGRATION OF LARGE PLANTS INTO RESTRICTED POWER SYSTEMS, COST AND FINANCING CONSIDERATIONS, AND QUESTIONS OF STAFFING AND LONG-TERM DEVELOPMENT. SOME OF THE CONSTRAINTS WHICH LIMIT EXPANSION ARE ILLUSTRATED, AS WELL AS THE CONDITIONS WHICH FAVOR DEVELOPMENT OF NUCLEAR POWER GENERATING SYSTEMS TO SUPPLY POWER TO DEVELOPING COUNTRIES. THE CONCLUSION IS THAT THE SOLUTIONS WHICH APPEAR MOST PROMISING ARE LONG TERM AND THAT THE POSSIBILITY OF RESHAPING THE ECONOMY OF WHOLE REGIONS WITH AMPLE AND CHEAP POWER IS STILL MORE THAN TEN YEARS AWAY.

*ECONOMIC CONDITIONS + *NUCLEAR ENERGY SOURCES + *POWER REQUIREMENTS + ECONOMIC EVALUATIONS + ENERGY COSTS + ENERGY SOURCES + POWER GROWTH SURVEYS + REGIONAL PLANNING + 0-500 MW(E) REACTORS

10-01154 SEARBY PJ

THE GROWTH OF DEMAND FOR ENERGY AND THE ROLE OF NUCLEAR POWER

U.K. ATOMIC ENERGY AUTHORITY, LONDON

PREPRINT OF PAPER SM-126/29 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT. 20-24, 1969

REVIEWING THE TREND OF WORLD ENERGY REQUIREMENTS, THE PAPER CONSIDERS THE ROLE OF ENERGY IN SEVERAL COUNTRIES IN WIDELY VARYING STAGES OF DEVELOPMENT AND ISOLATES SOME OF THE FACTORS CONTRIBUTING TO THEIR POSITIONS AND PROSPECTS. IT CONSIDERS THE POSSIBILITY OF RAISING DEVELOPING COUNTRIES TO A HIGHER STAGE OF DEVELOPMENT BY INCREASING THE SUPPLY OF ENERGY, ESPECIALLY NUCLEAR ENERGY, RECOGNIZING THAT THE INTRODUCTION OF NUCLEAR POWER IS A COMPLEX MATTER AFFECTING DIFFERENT COUNTRIES IN DIFFERENT WAYS. THE MAIN TECHNICAL AND ECONOMIC CHARACTERISTICS OF VARIOUS NUCLEAR REACTORS THE UK HAS DEVELOPED OR IS DEVELOPING, ARE EXAMINED AND THE COSTS OF NUCLEAR POWER GENERATION IN THE MEDIUM AND LONG TERM ARE CONSIDERED. THE ECONOMIC SIGNIFICANCE OF PROVEN AND PROJECTED NUCLEAR POWER SYSTEMS FOR DEVELOPING COUNTRIES IS DISCUSSED, WITH SPECIAL REFERENCE TO THE WIDER ECONOMIC, SOCIAL, AND POLITICAL FACTORS AFFECTING THE CHOICES AVAILABLE TO INDIVIDUAL COUNTRIES AND AREAS.

*ECONOMIC CONDITIONS + *NUCLEAR ENERGY SOURCES + *POWER REQUIREMENTS + ECONOMIC EVALUATIONS + ENERGY COSTS + ENERGY SOURCES + POWER GROWTH SURVEYS + REACTOR DESIGN + REGIONAL PLANNING + 0-500 MW(E) REACTORS

10-01155 GHALIB SA

THE STEAM GENERATING HEAVY WATER REACTOR

THE NUCLEAR POWER GROUP LTD., KNUTSFORD, ENGLAND

PREPRINT OF PAPER SM-126/30 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT. 20-24, 1969, 9 P, 4 FIG

TAKING ADVANTAGE OF A RELATIVELY LATE ENTRY INTO THE WATER REACTOR FIELD, THE UK HAS COMBINED IN THE STEAM GENERATING HEAVY WATER REACTOR THE BEST FEATURES OF EARLIER WATER REACTORS. THE ATTRACTIVE ECONOMICS OF THIS SYSTEM ARISE FROM THESE FEATURES - (1) THE USE OF LIGHT WATER COOLANT AND THE DIRECT CYCLE, COUPLED WITH A PARTICULARLY

ACCESSION NUMBER 10-01151 TO 10-01155

CATEGORY 10 - ENERGY SOURCES

10-01155 *CONTINUED*

SIMPLE CONSTRUCTION, LEADS TO A POTENTIALLY LOW COST SYSTEM, (2) THE PRESSURE TUBE CONSTRUCTION SIMPLIFIES ACCESS FOR REFUELLING AND PERMITS THE REACTOR TO OPERATE WITH A LOW FUEL INVENTORY, THUS ECONOMIZING IN FUEL COSTS, (3) THE USE OF HEAVY WATER AS A SEPARATE UNPRESSURIZED MODERATOR GIVES A GOOD NEUTRON ECONOMY AND HELPS TO REDUCE FUEL COSTS, AND (4) THE PRESSURE TUBE CONSTRUCTION USING FACTORY PREFABRICATED UNITS MAKES THE REACTOR PARTICULARLY ATTRACTIVE IN SMALLER UNIT SIZES AND FOR REMOTE SITES. THE PAPER EXAMINES THESE FEATURES AND SHOWS HOW THEY LEAD TO A SYSTEM PARTICULARLY SUITED TO THE REQUIREMENTS OF DEVELOPING COUNTRIES.

*FUEL COSTS + *HEAVY-WATER REACTORS + ECONOMIC CONDITIONS + ECONOMIC EVALUATIONS + ENERGY SOURCES + NUCLEAR ENERGY SOURCES + NUCLEAR STEAM SUPPLY SYSTEM + REACTOR DESIGN + REGIONAL PLANNING + 0-500 MW(E) REACTORS

10-01157 WORDSWORTH AD + COWHERD SJ

FACTORS AFFECTING THE COST OF NUCLEAR FUELS AND THE SELECTION OF REACTOR FUEL CYCLES IN THE DEVELOPING COUNTRIES

KENNEDY + DONKIN, WOKING, SURREY, UK

PREPRINT OF PAPER SM-126/31 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT. 20-24, 1969, 16 P, 3 TABLES, 7 FIG

ECONOMIC CONDITIONS IN DEVELOPING COUNTRIES HAVE A MARKED EFFECT ON SELECTION OF A SPECIFIC TYPE OF REACTOR SYSTEM WHICH CAN BE ECONOMICALLY ATTRACTIVE WHEN INTEGRATED INTO A NATIONAL NETWORK. SINCE ACCUMULATED FUEL COSTS FOR A TYPICAL PROVEN TYPE REACTOR WILL APPROXIMATELY EQUAL PLANT INVESTMENT COSTS WITHIN THE FIRST HALF OF THE DESIGNED PLANT LIFE, THE RELATIONSHIP OF FUEL COST TO THE TOTAL ENERGY COST STRUCTURE ASSUMES GREAT IMPORTANCE. THIS PAPER DISCUSSES THE VARIOUS FUEL REQUIREMENTS AND COSTS FOR PRESENT AND FUTURE REACTOR TYPES, AS WELL AS DIFFERENT SOURCES OF SUPPLY FROM OUTSIDE A DEVELOPING COUNTRY. FACTORS AFFECTING LOCAL FUEL MANUFACTURE ARE DISCUSSED, AND PREDICTABLE COSTS AND EFFECTS ON TOTAL ENERGY COST STRUCTURE ARE PRESENTED. VARIATIONS IN INTERNAL AND EXTERNAL FINANCE REQUIREMENTS AND INTEREST RATES ARE ALSO DISCUSSED. THE SECOND PART OF THE PAPER COVERS THE EFFECT ON FUEL COSTS OF THE INTRODUCTION OF DUAL- AND MULTI-PURPOSE NUCLEAR COMPLEXES IN WHICH POWER GENERATION IS COMBINED WITH FRESH WATER PRODUCTION, DISTRICT HEATING SUPPLIES AND SERVICES FOR INDUSTRY AND AGRICULTURE. THE SOCIO-ECONOMIC BENEFITS ARE DISCUSSED, AND THE INFLUENCE OF NUCLEAR FUEL COSTS ON THE TOTAL COST STRUCTURE IS INVESTIGATED.

*FUEL COSTS + *NUCLEAR FUEL CYCLE COSTS + *REGIONAL PLANNING + AGRO-INDUSTRIAL COMPLEXES + DUAL-PURPOSE PLANT + ECONOMIC CONDITIONS + ECONOMIC EVALUATIONS + NUCLEAR DESALINATION + REVIEWS

10-01161 FAUDE D + JANSEN P + SEETZEN J

MODELS FOR ECONOMIC CONSIDERATIONS ON THE INTRODUCTION OF NUCLEAR ENERGY

GESELLSCHAFT FÜR KERNFORSCHUNG M.B.H., KARLSRUHE, GERMANY

PREPRINT OF PAPER SM-126/32 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT. 20-24, 1969

INTRODUCTION OF NUCLEAR ENERGY RESULTS IN REDUCTION IN ENERGY GENERATING COSTS AND THUS DIRECTLY BENEFITS A NATIONAL ECONOMY. NUCLEAR ENERGY WILL BE INTRODUCED IN TWO STEPS - (1) PROVEN REACTOR TYPES WILL BE INSTALLED, ESPECIALLY LIGHT WATER MODERATED AND HEAVY WATER MODERATED THERMAL CONVERTERS. THESE TYPES WILL BE DOMINANT IN THE 1970S. THEY ARE, HOWEVER, CHARACTERIZED BY POOR NUCLEAR FUEL UTILIZATION, AND EXCLUSIVE USE OF THESE TYPES WOULD SOON EXHAUST CHEAP URANIUM SOURCES. HIGHER URANIUM PRICES WOULD INCREASE ENERGY GENERATING COSTS BEFORE THE END OF THIS CENTURY. ADVANCED REACTOR TYPES, ESPECIALLY SODIUM-COOLED FAST BREEDERS, WILL BE DEVELOPED AND WILL BE USED INCREASINGLY IN THE 1980S. THEY WILL PROBABLY CONSTITUTE THE LONG-TERM SOLUTION.

*ECONOMIC CONDITIONS + *NUCLEAR ENERGY SOURCES + *NUCLEAR FUEL CYCLE COSTS + BOILING-WATER REACTORS + BREEDER REACTORS + CONVERTER REACTORS + ECONOMIC EVALUATIONS + ENERGY COSTS + ENERGY SOURCES + FUEL COSTS + HEAVY-WATER REACTORS

10-01162 BOWERS HI + WICHNER RP

TRANSMISSION COSTS VERSUS NEAR-LOAD SITING COSTS FOR INLAND REGIONS DEFICIENT IN COOLING WATER OAK RIDGE NATIONAL LABORATORY, TENN.

PREPRINT OF PAPER SM-126/33 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT. 20-24, 1969, 19 P, 8 FIG, 9 REF

A GENERAL STUDY WAS MADE OF THE COSTS OF SUPPLYING POWER TO AN INLAND CITY WITH AN OFFSHORE GENERATING PLANT AS COMPARED TO POWER COSTS FROM A NEAR-LOAD FACILITY. IT WAS ASSUMED THAT COOLING WATER WAS IN SHORT SUPPLY NEAR THE CITY, NECESSITATING USE OF A DRY COOLING TOWER FOR THE NEAR-LOAD PLANT, RESULTING IN HIGHER COSTS AND LOWER THERMAL EFFICIENCY. THE OFFSHORE SITE HAD THE ADVANTAGE OF REQUIRING LOWER SAFEGUARDS COSTS AND THE DISADVANTAGES OF HIGHER SITE PREPARATION COSTS AND HIGHER LABOR COSTS DURING CONSTRUCTION. THE STUDY INDICATES THAT THE COST OF ENERGY AT THE BUS BAR WOULD BE LOWER FOR THE OFFSHORE PLANT BY 0.1 MILL/KWHR FOR A 1000 MW(E) BREEDER REACTOR WITH PUBLIC FINANCING AND UP TO 0.5 MILL/KWHR FOR A 10,000 MW(E) LIGHT-WATER REACTOR WITH PRIVATE FINANCING. THESE SAVINGS IN THE COST OF POWER GENERATION WERE THEN APPLIED TO THE COST OF TRANSMITTING POWER TO THE INLAND CITY. IT WAS FOUND THAT, WHEN COMPARING PLANTS OF EQUAL CAPACITY, TRANSMISSION DISTANCES OF 4 TO 80 MILES COULD BE ACCOMMODATED FROM THE SAVINGS ON GENERATION COSTS, ASSUMING PRESENT-DAY TRANSMISSION TECHNOLOGY. WHEN IT IS ASSUMED THAT LARGE (10,000MW) OFFSHORE PLANTS SUPPLY SMALLER (1000 MW) INLAND LOADS, ALLOWABLE TRANSMISSION DISTANCES RANGED FROM 100 TO 480 MILES.

*OFFSHORE ISLAND SITING + *POWER TRANSMISSION COSTS + *SITE PREPARATION COSTS + AEC SPONSORED + BREEDER REACTORS + CONVERTER REACTORS + COOLING TOWERS + SITE PREPARATIONS

CATEGORY 20 - ENERGY UTILIZATION (COUPLING)

20-00977 LAGOWSKI JP

NUCLEAR-POWER SEA-WATER CONVERSION PLANT
ATOMIC ENERGY COMMISSION, WASHINGTON

U.S.PAT. 3,303,098 (7-19-65/2-7-67), 5 FIG, 12 REF

A METHOD OF COUPLING A WATER COOLED NUCLEAR REACTOR TO A SEAWATER DISTILLATION PLANT. THE REACTOR IS LOCATED AT THE BOTTOM OF A PIT, 130 FT OR MORE IN DEPTH, WITH COOLANT ABOVE THE REACTOR SUFFICIENT TO SUPPRESS THE BOILING OF THE COOLANT AT A TEMPERATURE SUFFICIENTLY HIGH TO OPERATE THE FLASH DISTILLATION PLANT. A SECOND PIT ADJACENT TO THE REACTOR PIT CONTAINS THE BRINE HEATER. DEMINERALIZED COOLING WATER TRANSFERS HEAT FROM THE REACTOR TO THE BRINE HEATER.

*COUPLING (REACTOR-DESALTING PLANT) + *NUCLEAR ENERGY SOURCES + *PRESSURIZED-WATER REACTORS + AEC SPONSORED + BREEDER REACTORS + DISTILLATION PROCESSES + ENERGY SOURCES + FLASH EVAPORATION + FLOWSHEETS + MULTISTAGE FLASH DISTILLATION + PATENTS

20-01065 BIONDI L + PANSERI D + PIERAZZI L

THE ROVI REACTOR - SELECTION OF THE FUEL ELEMENT AND RELATED PROBLEMS
MONTECATINI EDISON + BREDA + CNEN, ITALY

P. 311-18 IN NUCLEAR DESALINATION - PROC. IAEA SYMP., MADRID, NOV. 1968, ELSEVIER, 1969. WAS PAPER SM-113/2 AT SYMP.

THE ORGANIC COOLED AND MODERATED ROVI REACTOR HAS A CAPACITY OF 100 MW(T) AND IS INTENDED FOR USE WITH A WATER-ONLY 13 MGD PLANT. ADVANTAGES AND DISADVANTAGES OF EACH OF SEVERAL SOLUTIONS UNDER CONSIDERATION FOR THE CORE AND FUEL ELEMENT ARE DISCUSSED. THE REFERENCE SOLUTION SELECTED IS ONE USING URANIUM CARBIDE CLAD WITH SAP (SINTERED ALUMINUM POWDER). THIS SOLUTION GIVES RISE TO PROBLEMS RELATED TO THE BEHAVIOR OF SAP UNDER CREEP CONDITIONS DUE TO THE SWELLING OF THE URANIUM CARBIDE. SEVERAL TECHNOLOGICAL SOLUTIONS ARE DESCRIBED, WITH PARTICULAR ATTENTION TO THOSE WHICH SO FAR APPEAR TO OFFER THE MOST ADVANTAGES AND GREATEST SAFETY. (IN ITALIAN)

*CONVERTER REACTORS + *NUCLEAR ENERGY SOURCES + *REACTOR DESIGN + CLADDING + ENERGY SOURCES + REACTOR DYNAMICS + SAFETY + 0-50 MGD PLANT

20-01085 JOHNSON KO

ABSTRACTS OF LITERATURE ON THE DISTILLATION OF SEAWATER AND ON THE USE OF NUCLEAR ENERGY FOR
DESALTING - 1

OAK RIDGE NATIONAL LABORATORY, TENN.

ORNL-TM-2691 (NOV. 1969), 216 P

ABSTRACTS ARE GIVEN FOR APPROXIMATELY 900 PUBLISHED ARTICLES RELATED TO THE DESALINATION OF SEAWATER. THE BODY OF THE REPORT IS A COPY OF INFORMATION STORED IN A COMPUTERIZED STORAGE AND RETRIEVAL SYSTEM ON DESALINATION AT THE OAK RIDGE NATIONAL LABORATORY. THE ABSTRACTS ARE GROUPED IN NINE CATEGORIES. AUTHOR AND KEYWORD INDEXES TO THE ARTICLES REFERENCED ARE PROVIDED. THE KEYWORDS, WHICH IDENTIFY THE CONTENT OF THE ARTICLES, WERE CHOSEN FROM A THESAURUS DEVELOPED AT ORNL.

*BIBLIOGRAPHIES + AEC SPONSORED + OSW SPONSORED

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

- 30-00958 LEITNER GF
DESIGN AND CONSTRUCTION OF THE WORLDS LARGEST FLASH TYPE DESALTING PLANT AT TIJUANA, MEXICO
AQUA-CHEM, INC., WAUKESHA, WIS.
PAGES C-1-5 IN PROC. WESTERN WATER POWER SYMP., LOS ANGELES, APR. 1968, WESTERN PERIODICALS, NORTH HOLLYWOOD, CALIF. (1968), 3 FIG, 4 REF
A \$7,000,000 TURNKEY CONTRACT HAS BEEN AWARDED TO AQUA-CHEM BY THE MEXICAN GOVERNMENT FOR THE CONSTRUCTION OF A 7.5-MGD DESALTING PLANT AT TIJUANA. THE PLANT WILL BE OF THE LONG-TUBE MULTISTAGE FLASH TYPE WITH A PERFORMANCE RATIO OF 10. IT WILL CONSIST OF TWO 3.75-MGD, 44-STAGE MODULES OPERATING ON A BRINE RECIRCULATING CYCLE WITH A MAXIMUM BRINE TEMPERATURE OF 235 DEG F. IN THAT THE SPECIFICATIONS AND CONTRACT WERE FOR A TURNKEY PLANT, AQUA-CHEM WAS GIVEN FREEDOM TO COORDINATE ALL OF THE VARIABLES TO PRODUCE A PLANT CONFORMING WITH THE PERFORMANCE SPECIFICATIONS. PERHAPS THE MOST IMPORTANT REASON FOR A DESALTING PLANT MANUFACTURER ALSO HAVING RESPONSIBILITY FOR DESIGN OF THE PLANT IS THAT IN THE FINAL ANALYSIS THE CUSTOMER MUST LOOK TO SOMEONE TO GUARANTEE THAT THE PLANT WILL MEET THE SPECIFIED PERFORMANCE. ANY OTHER PLAN IS ALMOST UNWORKABLE - FOR EXAMPLE, TO HAVE ONE FIRM DESIGN THE PLANT, ANOTHER FIRM MANUFACTURE IT, AND A THIRD FIRM INSTALL IT WOULD ONLY LEAD TO CHAOS. NO ONE COULD RIGHTFULLY BE EXPECTED TO GUARANTEE PERFORMANCE UNDER SUCH A SITUATION.
*DESIGN + *HORIZONTAL TUBE EVAPORATORS + *MEXICO + *MULTISTAGE FLASH DISTILLATION +
*PLANT CONSTRUCTION + CAPITALIZED COSTS + DISTILLATION PROCESSES + FLASH EVAPORATION + FLOWSHEETS + WATER COSTS ESTIMATE + 0-50 MGD PLANT
- 30-00960 SEPHTON HM
FLASH EVAPORATION AND CONDENSATION APPARATUS
U.S.PAT. 3,285,832 (4-22-63/11-15/66), 2 FIG, 5 REF
THE DESIGN OF A COMBINATION FLASH EVAPORATOR-CONDENSER UNIT FOR EITHER SINGLE OR MULTISTAGE OPERATION. IN THE EVAPORATOR SECTION, FLASHING IS DESIGNED TO TAKE PLACE MAINLY IN A CIRCULAR FLASH TUBE THROUGH WHICH THE HOT LIQUID IS INTRODUCED INTO A CYLINDRICAL EVAPORATOR UNIT MAINTAINED UNDER REDUCED PRESSURE. THE THERMAL EFFICIENCY IS IMPROVED BY MAINTAINING A SWIRLING ACTION IN THE VAPOR AS WELL AS THE LIQUID PHASE. THE CONDENSATION COIL IS LOCATED IN THE UPPER SECTION OF THE UNIT AND CONDENSATE IS COLLECTED IN AN OPEN GUTTER UNDER AND FOLLOWING THE ENTIRE LENGTH OF THE COIL. THIS APPARATUS ALLOWS THE USE OF RELATIVELY SMALL EVAPORATION UNITS AS COMPARED TO A CONVENTIONAL PROCESS OF THE SAME PRODUCTION CAPACITY.
*COMPONENT DESIGNS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + COMPONENT DEVELOPMENT + CONDENSERS + DESIGN + DISTILLATION PROCESSES + EVAPORATORS + FLASH EVAPORATION + MULTISTAGE FLASH DISTILLATION + PATENTS
- 30-00961 ERB RA + THELEN E + VARKER RD
USE OF SILVER SURFACES TO PROMOTE DROPWISE CONDENSATION
U.S. DEPT. OF THE INTERIOR, WASHINGTON
U.S.PAT. 3,289,754 (11-2-64/12-6-66), 1 FIG, 4 REF
IT HAS BEEN FOUND THAT VERY EFFECTIVE DROPWISE CONDENSATION ON CONDENSER SURFACES MAY BE ACHIEVED BY THE USE OF SILVER AS THE SURFACE ON WHICH THE WATER CONDENSES. THIS SILVER SURFACE MAY BE ACHIEVED BY THE USE OF SOLID SILVER OR BY COATING ANOTHER METAL WITH SILVER.
*DROPWISE CONDENSATION + *HEAT TRANSFER IMPROVEMENTS + *SILVER + CONDENSATION PROMOTERS + CONDENSERS + DISTILLATION PROCESSES + FABRICATION MATERIALS + HEAT TRANSFER + HEAT TRANSFER SURFACES + PATENTS
- 30-00962 ERB RA
USE OF GOLD SURFACES TO PROMOTE DROPWISE CONDENSATION
U.S. DEPT. OF THE INTERIOR, WASHINGTON
U.S.PAT. 3,289,753 (11-2-64/12-6-66), 1 FIG, 3 REF
IT HAS BEEN FOUND THAT VERY EFFECTIVE DROPWISE CONDENSATION ON CONDENSER SURFACES MAY BE ACHIEVED BY THE USE OF GOLD AS THE SURFACE ON WHICH THE WATER CONDENSES. THIS GOLD SURFACE MAY BE ACHIEVED BY THE USE OF SOLID GOLD OR BY COATING ANOTHER METAL WITH GOLD.
*DROPWISE CONDENSATION + *GOLD + *HEAT TRANSFER IMPROVEMENTS + CONDENSATION PROMOTERS + CONDENSERS + DISTILLATION PROCESSES + FABRICATION MATERIALS + HEAT TRANSFER + HEAT TRANSFER SURFACES + PATENTS
- 30-00963 BROWN KD
APPARATUS FOR DIRECT CONTACT CONDENSATION OF VAPORS
U.S.PAT. 3,290,229 (1-25-62/12-6-66), 7 FIG, 8 REF
THE INVENTION RELATES TO VACUUM PUMPS AND TO SYSTEMS EMPLOYING SUCH PUMPS. IN ONE SYSTEM, A VACUUM PUMP IS PROVIDED WHICH CONSISTS OF A TANK CONTAINING A BODY OF LIQUID IN WHICH IS IMMERSSED A PUMP HAVING A ROTOR OF THE SCREW OR HELICAL TYPE ARRANGED IN A CYLINDER OR SHROUD CLOSED AT ONE END AND OPENING INTO THE TANK AT THE OTHER. THE PUMP IS PROVIDED WITH A GAS INLET AND A LIQUID INLET ADJACENT TO ITS CLOSED END, THE LIQUID INLET BEING ARRANGED TO ADMIT LIQUID FROM THE TANK. THE PUMP DURING OPERATION PRODUCES A VORTEX IN THE SHROUD AND THE VORTEX IS CONTROLLED BY ADJUSTING THE LIQUID INLET OPENING. BY PROPER ADJUSTMENT OF THE RATE OF RECIRCULATION OF THE LIQUID A HIGHLY EFFECTIVE PUMPING ACTION IS OBTAINED WHICH IS CAPABLE OF MAINTAINING A HIGH VACUUM. THE PUMP OPERATES EFFECTIVELY AS A VACUUM PUMP AND CAN BE EMPLOYED IN COMBINATION WITH AN EVAPORATIVE PURIFYING SYSTEM FOR WATER AND PROVIDES AN EFFICIENT EVAPORATIVE SYSTEM FOR DESALTING SEAWATER.
*DIRECT CONTACT HEAT EXCHANGE + *PUMPS + *VACUUM SYSTEMS + DISTILLATION PROCESSES + FLASH EVAPORATION + MULTISTAGE FLASH DISTILLATION + PATENTS + WATER JET EJECTORS
- 30-00964 DIEDRICH GE + LOTZ CW
DISTILLATION APPARATUS HAVING CORRUGATED HEAT TRANSFER SURFACES
GENERAL ELECTRIC CO., NEW YORK
U.S.PAT. 3,291,704 (6-28-63/12-13-66), 4 FIG, 12 REF
IN A PREFERRED FORM OF THE INVENTION, EVAPORATING AND CONDENSING SURFACES ARE CONSTRUCTED ON OPPOSITE SIDES OF A HEAT TRANSFER WALL WHICH MAY BE USED IN

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-00964 *CONTINUED*

DISTILLATION APPARATUS. THE CONFIGURATION OF THESE SURFACES IS GENERALLY A SERIES OF ELONGATED PARALLEL PROTUBERANCES OR CONVOLUTIONS. THESE PROTUBERANCES OR CONVOLUTIONS ARE OF SUCH DIMENSIONS THAT THEY CAN EASILY BE FORMED BY USING A DIE, ROLLING OR EXTRUSION. IN USE, THE SALINE WATER OR DISTILLAND IS DELIVERED TO THE EVAPORATING SURFACE NEAR ITS TOP SO THAT IT WILL RUN DOWN THE SURFACE BETWEEN THE PROTUBERANCES UNDER THE INFLUENCE OF GRAVITY. THE AMOUNT OF DISTILLAND SUPPLIED DOES NOT COMPLETELY FILL THE AREA BETWEEN THE PROTUBERANCES. THE HEAT TRANSFERRED THROUGH THE WALL FROM THE CONDENSING SURFACE CAUSES THE DISTILLAND TO BOIL WHICH SPLASHES THE DISTILLAND OVER THE SURFACES OF THE PROTUBERANCES. THE WALL IS CONSTRUCTED OF A MATERIAL WHICH THE DISTILLAND WETS OR ADHERES TO, BUT AT THE SAME TIME, THE SURFACE TENSION OF THE DISTILLAND TENDS TO PULL ANY EXCESS DISTILLAND INTO THE DEPRESSIONS BETWEEN THE PROTUBERANCES. THE OVERALL EFFECT IS THAT THE DISTILLAND SPREADS IN A VERY THIN FILM OVER THE SURFACES OF THE PROTUBERANCES. THIS FILM IS CONTINUOUSLY REPLENISHED, AS IT EVAPORATES, BY MORE DISTILLAND SPLASHING FROM THE GROOVES.

*EXTENDED HEAT TRANSFER SURFACES + *HEAT TRANSFER IMPROVEMENTS + CONDENSERS + DISTILLATION PROCESSES + EVAPORATORS + HEAT TRANSFER + HEAT TRANSFER COEFFICIENT + HEAT TRANSFER SURFACES + HEATER - CONDENSER TUBES + HEATER - EVAPORATOR TUBES + PATENTS + TUBING (METAL)

30-00965 KEMPER CA + HARPER GF + BROWN GA

MULTIPLE-PHASE EJECTOR DISTILLATION APPARATUS AND DESALINATION PROCESS
JOSEPH KAYE AND CO., CAMBRIDGE, MASS.

U.S.PAT. 3,288,685 (8-17-62/11-29-66), 1 FIG, 9 REF

A PROCESS FOR THE DISTILLATION OF A LIQUID AND THE PARTIAL REGENERATION OF THE LATENT HEAT OF VAPORIZATION CONSISTING OF THE STEPS (1) INCREASING THE PRESSURE OF A LIQUID STREAM, (2) ACCELERATING AND EXPANDING THE LIQUID STREAM BY CONVERGING AND THEN DIVERGING IT TO OBTAIN A HIGH VELOCITY STREAM, (3) ACCELERATING A SEPARATE VAPOR STREAM, OBTAINED FROM A BODY OF LIQUID, BY CONVERGING THE VAPOR STREAM, (4) MIXING THE HIGH VELOCITY STREAM AND THE ACCELERATED VAPOR STREAM BY PASSING THEM TOGETHER THROUGH A CONVERGING MIXING CHAMBER, (5) DECELERATING THE RESULTANT MIXED VAPOR AND LIQUID STREAM BY DIVERGING IT TO OBTAIN AN EXIT STREAM HAVING A HIGHER TEMPERATURE THAN THE VAPOR STREAM PRIOR TO ACCELERATION, AND (6) PLACING THE EXIT STREAM IN A HEAT EXCHANGE RELATIONSHIP WITH THE BODY OF LIQUID FROM WHICH THE VAPOR WAS OBTAINED TO CONDENSE AT LEAST A PORTION OF THE STREAM AND THEREBY PROVIDING A PARTIAL RETURN OF THE LATENT HEAT OF VAPORIZATION TO THE LIQUID BODY.

*HEAT RECOVERY + *STEAM JET EJECTORS + *SYSTEM DESCRIPTIONS + DISTILLATION PROCESSES + FLOWSHEETS + HEAT BALANCE + PATENTS

30-00966 GUERRIERI SA + BOGART MJP

MULTIPLE-EFFECT EVAPORATION UTILIZING SUBMERGED COMBUSTION HEAT
LUMMUS CO., NEW YORK

U.S.PAT. 3,285,834 (12-10-62/11-15-66), 1 FIG, 11 REF

A PROCESS IN WHICH CONCENTRATED BRINE FROM A MULTIEFFECT EVAPORATION SYSTEM IS PASSED TO A SUBMERGED COMBUSTION UNIT FOR FURTHER CONCENTRATION. THE SLURRY FORMED IN THE SUBMERGED COMBUSTION UNIT IS FILTERED TO REMOVE THE SOLIDS CONTENT AND THE MOTHER LIQUOR RETURNED TO THE SUBMERGED COMBUSTION UNIT. THE HEAT CONTENT OF THE STEAM AND COMBUSTION PRODUCTS FORMED IN THE SUBMERGED COMBUSTION UNIT PROVIDE THE HEAT REQUIREMENTS FOR OPERATION OF THE MULTIEFFECT EVAPORATION SYSTEM. THE SOLID RESIDUE WITHDRAWN FROM THE FILTERING STEP IS THEN DISPOSED OF IN ANY SUITABLE MANNER.

*DIRECT CONTACT HEAT EXCHANGE + *MULTIPLE EFFECT DISTILLATION + *SYSTEM DESCRIPTIONS + DISTILLATION PROCESSES + FLOWSHEETS + HEAT BALANCE + HEAT TRANSFER + PATENTS + WASTE DISPOSAL

30-00967 ZIMMERMANN FJ

WATER VOLATILIZATION-CONDENSATION PURIFICATION PROCESS USING INERT GAS
STERLING DRUG, INC., NEW YORK

U.S.PAT. 3,285,833 (6-19-64/11-15-66), 7 FIG, 5 REF

A PROCESS FOR OBTAINING PURE WATER FROM WATER CONTAINING SALT OR OTHER NONVOLATILE MATERIAL. THE STEPS CONSIST OF (1) CONTINUOUSLY MIXING WITH THE SEAWATER A NONCONDENSABLE GAS AT 500 TO 1000 PSI, (2) PASSING THE LIQUID AND GASEOUS PHASE AS A CONCURRENT FLOWING INTIMATE MIXTURE THROUGH A HEAT EXCHANGER, (3) THEN PASSING THE GASEOUS PHASE OF THE HEATED MIXTURE OBTAINED FROM THE HEAT EXCHANGE ZONE IN COUNTERCURRENT SEPARATED HEAT EXCHANGE WITH THE MIXTURE IN THE HEAT EXCHANGER, (4) SUPPLYING ENERGY TO GASEOUS PHASE OF THE HEATED MIXTURE OBTAINED FROM THE HEAT EXCHANGER PRIOR TO RETURNING IT TO THE HEAT EXCHANGER. THE TEMPERATURE OF THE GASEOUS PHASE IS RAISED TO ABOUT 365 TO 450 DEG F SO THAT WHEN IT IS RETURNED TO THE HEAT EXCHANGER ABOUT 75% OF THE WATER IN THE LIQUID PHASE IN THE HEAT EXCHANGER IS VAPORIZED. THE TEMPERATURE OF THE GASEOUS PHASE IN THE HEAT EXCHANGER IS COOLED SUFFICIENTLY IN THE REGION WHERE THE FEEDWATER ENTERS SO THAT PRODUCT WATER CONDENSES. THE NONCONDENSABLE GAS IS RECIRCULATED.

*DIRECT CONTACT HEAT EXCHANGE + *HUMIDIFICATION PROCESSES + *SYSTEM DESCRIPTIONS + CONDENSERS + DISTILLATION PROCESSES + EVAPORATORS + FLOWSHEETS + HEAT EXCHANGERS + PATENTS

30-00968 HERBERT LS + STERNS UJ

METHOD FOR PREVENTING SCALE DEPOSITION
COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, EAST MELBOURNE, AUSTRALIA

U.S.PAT. 3,293,152 (8-14-63/12-20-66), 4 FIG, 3 REF

A METHOD TO PREVENT THE FORMATION OF SCALE IN DISTILLATION OR EVAPORATION APPARATUS. AN ORGANIC POLYMER, SUCH AS POLYACRYLIC ACID, IS ADDED TO THE SALINE WATER TO THE EXTENT OF ABOUT 3 PPM. THE POLYMER IS CAPABLE OF FORMING AT THE HEAT TRANSFER SURFACES A FILM OR SHEATH WHICH EITHER EXCLUDES THE SCALE FROM THE SURFACES OR IS COCODEPOSITED WITH THE SCALE. WHEN THE FILM INCREASES TO A CRITICAL THICKNESS IT BREAKS AWAY FROM THE SURFACE TO LEAVE THE SURFACE SUBSTANTIALLY FREE FROM SCALE. THE FILM IS REDEPOSITED ON THE CLEAN SURFACE AND AGAIN BREAKS AWAY, THE OVERALL EFFECT BEING THAT

ACCESSION NUMBER 30-00964 TO 30-00968

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-00968 *CONTINUED*

THE HEAT TRANSFER SURFACES ARE AUTOMATICALLY MAINTAINED ESSENTIALLY FREE OF SCALE.

*CHEMICAL ADDITIVES + *SCALE PREVENTION + DISTILLATION PROCESSES + FEEDWATER TREATMENT + PATENTS + SCALE REMOVAL + SCALING

30-00969 GUNTHER DA

PROCESS FOR PREVENTING THE FORMATION OF BOILER SCALE

AMERICAN STERILIZER CO., ERIE, PA.

U.S.PAT. 3,308,062 (3-24-65/3-7-67), 7 REF

THE PROCESS RELATES TO AN EFFECTIVE MEANS OF PREVENTING SCALE FORMATION IN BOILERS, EVAPORATORS AND THE LIKE BY A CONTROLLED ADDITION OF GLUCONIC ACID TO THE FEED WATER.

A METERING DEVICE IS USED TO MAINTAIN A PH OF 8.5 IN THE BOILING EVAPORATOR AND

PERIODIC SAMPLING IS DONE TO MAINTAIN THE PROPER PH LEVEL.

*CHEMICAL ADDITIVES + *SCALE PREVENTION + DISTILLATION PROCESSES + FEEDWATER TREATMENT + PATENTS + SCALING

30-00970 LCEBEL FA

METHOD OF SCALE CONTROL IN SEA WATER EVAPORATION

AQUA-CHEM, INC., WIS.

U.S.PAT. 3,305,455 (2-6-63/2-21-67), 1 FIG, 9 REF

A METHOD RELATED TO SCALE CONTROL ON EVAPORATOR TUBES BY UTILIZING THE FORMATION OF WATER SOLUBLE CALCIUM SULFATE. DURING THE EVAPORATION CYCLE, SEAWATER AT BRINE CONCENTRATION OF ABOUT 100,000 PPM IS HEATED TO A PRESELECTED TEMPERATURE OF ABOUT 215 DEG F AND A PRESSURE OF ABOUT 15 PSIA. UNDER THESE CORRELATED CONDITIONS, MAJOR PORTION OF THE SCALES FORMED IS THE WATER SOLUBLE CALCIUM SULPHATE ALONG WITH SMALL PORTIONS OF WATER INSOLUBLE MAGNESIUM HYDROXIDE AND CALCIUM CARBONATE. FOR REMOVAL OF THE WATER SOLUBLE SCALE, THE EVAPORATION CYCLE IS INTERRUPTED AT CONVENIENT INTERVALS. REMOVAL OF BOTH WATER SOLUBLE AND INSOLUBLE SCALES IS ACCOMPLISHED BY SPRAYING FRESH WATER FROM THE CONDENSATE STORAGE ON THE SCALED SURFACES- THE SOLUBLE SCALES ARE DISSOLVED AND THE INSOLUBLE CONSTITUENTS ARE MECHANICALLY BROKEN UP AND WASHED AWAY.

*SCALE REMOVAL + DISTILLATION PROCESSES + PATENTS + PHYSICAL CHEMISTRY OF SCALE + SCALE PREVENTION + SCALING

30-00971 KEHCE EC + WALKER EC

METHOD AND APPARATUS FOR DEGASSING AND DISTILLING LIQUID

SALINE WATER CONVERSION CORP., NEW YORK

U.S.PAT. 3,344,584 (7-29-64/10-3-67), 4 FIG, 4 REF

A TECHNIQUE AND APPARATUS FOR HANDLING LIQUIDS AND THE GASES RELEASED FROM THEM WHEN THEY ARE SUBJECTED TO REDUCED PRESSURES. THE SYSTEM INVOLVES WITHDRAWING FROM THE LIQUID THE GASES RELEASED, PROCESSING THE LIQUID AT THE REDUCED PRESSURE, AND THEN REINGESTING THE GASES BACK INTO THE LIQUID AS IT RETURNS TO A REGION OF HIGHER PRESSURE. THE REINGESTION OF THE GASES BACK INTO THE LIQUID SOLUTION IS MADE POSSIBLE BY CAUSING THE LIQUID TO FLOW AT A HIGH VELOCITY FROM ITS LOW PRESSURE REGION TO A REGION OF HIGHER PRESSURE AND THEN INJECTING THE GASES IN THE FORM OF BUBBLES INTO THIS LIQUID FLOW AT A POINT OF LOW PRESSURE. IF THE FLOW IS RAPID ENOUGH, THE INJECTED BUBBLES WILL BE CARRIED BY THE LIQUID TOWARD THE HIGH PRESSURE REGION.

*DEAERATION + *DEAERATORS + ABSORBERS + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + FEEDWATER TREATMENT + PATENTS + SYSTEM DESCRIPTIONS + VACUUM SYSTEMS + VENTING + WATER JET EJECTORS

30-00972 THOMSEN AM

METHOD OF PROCESSING SEA WATER

U.S.PAT. 3,147,072 (1-4-61/9-1-64), 1 FIG, 9 REF

WASTE HEAT FROM AN ELECTRICITY PRODUCING GAS TURBINE IS EXTRACTED FROM EXHAUST GASES BY COUNTERFLOWING SEAWATER WITH THE GASES IN A MULTIPLE-EFFECT SCRUBBER. THE HEATED SEAWATER IS STRIPPED OF ITS MAGNESIUM AND CALCIUM BY CHEMICAL TREATMENT AND PRECIPITATION. THE SEAWATER IS THEN FLASH EVAPORATED AND CONDENSED BY CONVENTIONAL PROCESSES TO PRODUCE FRESH WATER. HIGH PERCENTAGE OF INPUT ENERGY CONVERSION TO USEFUL PURPOSES IS CLAIMED.

*GAS TURBINES + *HEAT RECOVERY SYSTEM + *MULTIPLE EFFECT DISTILLATION + CHEMICAL ADDITIVES + DISTILLATION PROCESSES + FEEDWATER TREATMENT + FLOWSHEETS + HEAT RECOVERY + PATENTS + PRECIPITATION + REMOVAL FROM FEEDWATER, CALCIUM + REMOVAL FROM FEEDWATER, MAGNESIUM + SYSTEM DESCRIPTIONS

30-00973 LYNAM JP

SEA WATER CONVERSION APPARATUS

U.S.PAT. 3,152,053 (7-26-60/10-6-64), 1 FIG, 4 REF

THIS INVENTION PROVIDES A MULTISTAGE FLASH EVAPORATOR WITH AN AUXILIARY CONDENSER OR HEATER IN THE CONVENTIONAL POSITION BETWEEN THE EXIT FROM THE CONDENSER SECTIONS OF THE EVAPORATOR AND THE ENTRANCE TO THE FLASH STAGES, AN AUXILIARY FLASH CHAMBER DOWNSTREAM FROM THE EXIT FROM THE FLASH CHAMBERS OF THE EVAPORATOR, AND A VAPOR COMPRESSOR WHICH DRAWS LOW PRESSURE VAPOR FROM THE AUXILIARY FLASH CHAMBER AND DISCHARGES IT AT A HIGHER PRESSURE INTO THE SHELL OF THE HEATER. IN THIS MANNER THE BRINE LEAVING THE EVAPORATOR IS FURTHER FLASH COOLED IN THE AUXILIARY FLASH CHAMBER AND THE HEAT REMOVED PLUS THE HEAT OF COMPRESSION IS TRANSFERRED TO THE HEATER. HIGH ENERGY RECOVERY IS CLAIMED, AT A LESSER INITIAL COST. LOW MAXIMUM TEMPERATURES AND LOW INCREASES IN SALINITY KEEP SCALE BUILD-UP TO A MINIMUM.

*MULTISTAGE FLASH DISTILLATION + *SYSTEM DESCRIPTIONS + *VAPOR COMPRESSION EVAPORATION + DESIGN DATA + DISTILLATION PROCESSES + FLASH EVAPORATION + HEAT RECOVERY SYSTEM + PATENTS

30-00974 KAYS DD + ROGERS CG + AKERLOW RW

MODULAR MULTIPLE-EFFECT FALLING-FILM EVAPORATOR

STEARNS-ROGER CORP., DENVER, COLO.

U.S.PAT. 3,322,648 (4-29-66/5-30-67), 6 FIG, 2 REF

THE DESIGN OF A MULTIEFFECT EVAPORATOR SYSTEM IN WHICH ALL OF THE PROCESSING STEPS,

ACCESSION NUMBER 30-00968 TO 30-00974

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-00974 *CONTINUED*

WITH THE EXCEPTION OF THE REMOVAL OF LOW PRESSURE VAPOR, ARE CARRIED OUT IN A SINGLE COMMON ENCLOSURE. THE SEVERAL SERIALY-INTERCONNECTED EFFECTS ARE SEPARATED FROM ONE ANOTHER BY INTERNAL BULKHEADS AROUND WHICH THE VAPOR PHASE FLOWS UNRESTRICTED, THUS ELIMINATING THE NEED FOR ANY INTER-EFFECT VAPOR PIPING. HEAT IS RECOVERED FROM THE CONDENSATE AS SOON AS IT ENTERS AN EFFECT BY PARTLY FLASHING WITHIN THE COMMON ENCLOSURE, THUS ELIMINATING A SEPARATE FLASH TANK. THUS, SOME OF THE PIPING NEEDS ARE ELIMINATED. THE FEED DELIVERED TO THE EVAPORATOR OF EACH EFFECT IS PERMITTED TO FLASH IN A DOME-LIKE PORTION OF THE MAIN ENCLOSURE THAT HOUSES THE SEVERAL EFFECTS. THE BOTTOMS OF THESE DOME-LIKE PORTIONS CONFINE THE FLASHED LIQUID AND DELIVER IT DIRECTLY TO THE UPPER EXTREMITIES OF THE EVAPORATOR TUBE SHEET WITH NO WASTE OF ENERGY SUCH AS WOULD TAKE PLACE IF THE LIQUID WERE SPRAYED INTO THE DOME. ALSO HOUSED WITHIN THE ENCLOSURE ARE THE HEAT TRANSFER SURFACES THAT PREHEAT THE FEED AND EVAPORATE THE FALLING LIQUID FILM. CONDENSATE IS DELIVERED TO A COMMON COLLECTION SUMP.

*COMPONENT DESIGNS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + *FALLING FILM EVAPORATION + *MODULAR CONSTRUCTION + *MULTIPLE EFFECT DISTILLATION + CONDENSERS + DESIGN + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + EVAPORATORS + FILM EVAPORATION + FLASH CHAMBERS + PATENTS

30-00975 MOCK AE

DIRECT CONTACT FLASH DISTILLATION WITH AIR AND STEAM

U.S.PAT. 3,326,778 (12-27-62/6-20-67), 1 FIG

THE INVENTION INVOLVES THE RAPID PASSAGE OF DRY GAS, USUALLY AIR, AT EXTREMELY HIGH TEMPERATURE THROUGH A BODY OF IMPURE WATER WHOSE SURFACE IS EXPOSED TO A GAS ENVIRONMENT OF RELATIVELY HIGH PRESSURE, WITH THE TEMPERATURE OF THE BODY OF IMPURE WATER BEING MAINTAINED JUST BELOW ITS BOILING POINT FOR THE PRESSURE EVEN THOUGH THE TEMPERATURE OF THE AIR IS SUBSTANTIALLY HIGHER THAN THIS BOILING POINT. THE AIR IS SATURATED WITH WATER VAPOR WHICH IN TURN CAN BE EXTRACTED BY CONDENSATION. THE TEMPERATURE OF THE BODY OF WATER IS MAINTAINED BELOW ITS BOILING POINT BY ADDING FEEDWATER TO THE BODY AS WELL AS WITHDRAWING CONCENTRATED BRINE FROM IT. THIS PROCEDURE IS FURTHER REFINED BY SENDING THE CONCENTRATED BRINE TO A FLASH EVAPORATOR SO THAT ITS HEAT IS NOT WASTED. THE APPARATUS FOR THIS PROCESS IS ALSO DESCRIBED. IN PARTICULAR, A STEAM EJECTOR IS EMPLOYED TO COMPRESS HOT DRY AIR PRIOR TO ITS INJECTION INTO THE BODY OF WATER. THE RESULT IS AN AIR-STEAM MIXTURE WHICH IS INTRODUCED INTO THE BODY OF WATER.

*DIRECT CONTACT HEAT EXCHANGE + *FLASH EVAPORATION + *STEAM JET EJECTORS + DISTILLATION PROCESSES + EVAPORATORS + HEAT EXCHANGERS + HEAT RECOVERY + HEAT TRANSFER + HUMIDIFICATION PROCESSES + PATENTS

30-00976 STANDIFORD FC

FALLING FILM EVAPORATOR

W.L. BADGER ASSOCIATES, INC., ANN ARBOR, MICH.

U.S.PAT. 3,303,106 (12-21-64/2-7-67), 3 FIG, 10 REF

A MULTIPLE EFFECT FALLING FILM EVAPORATOR SYSTEM HAVING VAPOR-LIQUID DISENGAGING CHAMBERS OF SUCCESSIVE EFFECTS STACKED ONE BELOW THE OTHER IN ORDER OF DECREASING BOILING PRESSURE FROM TOP TO BOTTOM. THE METHOD OPERATING CONSISTS OF SPLITTING THE FEED INTO TWO SIDE BY SIDE STEAMS OR FLOW PATHS. THE FIRST STEAM PASSES TO THE HIGHEST EFFECT ALONG THE FIRST FLOW PATH AND THE SECOND STEAM PASSES TO THE HIGHEST EFFECT IN THE SECOND FLOW PATH. THE UNEVAPORATED LIQUID FROM THE FIRST EFFECT IN EACH FLOW PATH PASSES TO THE SECOND HIGHEST EFFECT IN THE CORRESPONDING FLOW PATH. THE UNEVAPORATED LIQUID FROM A HIGHER PRESSURE EFFECT CAN BE FLASHED, PRIOR TO ITS PASSAGE TO THE NEXT LOWER EFFECT, TO PROVIDE HEATING VAPOR FOR THE NEXT LOWER EFFECT IN THE SAME PATH. ALSO THE FIRST PATH CAN OPERATE IN COUNTERFLOW WITH RESPECT TO VAPOR FLOW AND THE SECOND PATH BE SUBDIVIDED INTO TWO VERTICAL RANKS OF MULTIPLE EFFECT FORWARD FLOW EVAPORATOR EFFECTS.

*FALLING FILM EVAPORATION + *MULTIPLE EFFECT DISTILLATION + *SYSTEM DESCRIPTIONS + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + EVAPORATORS + FILM EVAPORATION + FLASH EVAPORATION + FLOWSHEETS + PATENTS + VERTICAL TUBE EVAPORATORS

30-00977 LAGOWSKI JP

NUCLEAR-POWER SEA-WATER CONVERSION PLANT

ATOMIC ENERGY COMMISSION, WASHINGTON

U.S.PAT. 3,303,098 (7-19-65/2-7-67), 5 FIG, 12 REF

A METHOD OF COUPLING A WATER COOLED NUCLEAR REACTOR TO A SEAWATER DISTILLATION PLANT. THE REACTOR IS LOCATED AT THE BOTTOM OF A PIT, 130 FT OR MORE IN DEPTH, WITH COOLANT ABOVE THE REACTOR SUFFICIENT TO SUPPRESS THE BOILING OF THE COOLANT AT A TEMPERATURE SUFFICIENTLY HIGH TO OPERATE THE FLASH DISTILLATION PLANT. A SECOND PIT ADJACENT TO THE REACTOR PIT CONTAINS THE BRINE HEATER. DEMINERALIZED COOLING WATER TRANSFERS HEAT FROM THE REACTOR TO THE BRINE HEATER.

*COUPLING (REACTOR-DESALTING PLANT) + *NUCLEAR ENERGY SOURCES + *PRESSURIZED-WATER REACTORS + AEC SPONSORED + BREEDER REACTORS + DISTILLATION PROCESSES + ENERGY SOURCES + FLASH EVAPORATION + FLOWSHEETS + MULTISTAGE FLASH DISTILLATION + PATENTS

30-00978 WILLIAMSON WR

DISTILLATION APPARATUS

AMERICAN MACHINE AND FOUNDRY CO., NEW JERSEY

U.S.PAT. 3,302,373 (7-3-63/2-7-67), 6 FIG, 11 REF

THE DESIGN OF A HORIZONTAL-TUBE VACUUM EVAPORATOR AND CONDENSER APPARATUS. IN A LOWER HORIZONTAL COMPARTMENT, HEATING WATER IS SUPPLIED TO COILS SURROUNDED BY SEAWATER FEED WHILE A VACUUM IS DRAWN ON THE ENTIRE APPARATUS. STEAM FROM THE BOILING SEAWATER LEAVES THE EVAPORATING CHAMBER AND PASSES THROUGH A WIRE MESH DEMISTER TO A HORIZONTAL TUBE CONDENSER LOCATED ABOVE THE EVAPORATOR. IN ONE SYSTEM, THE SEAWATER USED FOR COOLING IN THE CONDENSER PASSES THROUGH A WATER JET EJECTOR TO PROVIDE THE VACUUM FOR THE SYSTEM. THE EJECTOR BOTH REDUCES THE PRESSURE AND REMOVES THE NONCONDENSIBLE GASES. IN ANOTHER SYSTEM, THE PRODUCT WATER IS PUMPED FROM THE CONDENSER AND THIS

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-00978 *CONTINUED*

STEAM OPERATES THE WATER JET EJECTOR. IN THE LATTER CASE A HOLD-UP TANK IS PROVIDED FOR THE PRODUCT WATER SO THAT THERE WILL BE SUFFICIENT LIQUID AVAILABLE TO OPERATE THE EJECTOR. ALSO THE NONCONDENSIBLES SEPARATE IN THIS TANK.

*HORIZONTAL TUBE CONDENSERS + *HORIZONTAL TUBE EVAPORATORS + *WATER JET EJECTORS + COMPONENT DESIGNS + CONDENSERS + DESIGN + DISTILLATION PROCESSES + EVAPORATORS + PATENTS + SYSTEM DESCRIPTIONS + VACUUM SYSTEMS

30-00979 ROSS GW + ROSS DS
VACUUM DISTILLATION INCLUDING PREDEGASIFICATION OF DISTILLAND
AMCODYNE AND CO., LORAIN, OHIO
U.S.PAT. 3,300,392 (6-1-62/1-24-67), 7 FIG

APPARATUS TO PROVIDE A COMBINATION OF AN EFFICIENT WATER-DEAERATION SYSTEM AND A VACUUM DISTILLATION SYSTEM. THE DEAERATION SYSTEM IS OPERATED AT THE TEMPERATURE AT WHICH THE FEEDWATER IS OBTAINED AND PRODUCES GAS-FREE WATER. THE DEAERATED WATER IS THEN SENT TO A VACUUM DISTILLATION SYSTEM WHICH MAY BE OPERATED BELOW 100 DEG F WHERE MOST OF THE WATER IS EVAPORATED AND THE VAPORS CONDENSED. A VACUUM, PRODUCED BY THE DEAERATION SYSTEM, IS APPLIED TO THE STILL SO THAT THE DEAERATED WATER IS AT ITS BOILING POINT. A CLOSED CYCLE GAS COMPRESSION AND EXPANSION SYSTEM IS PROVIDED IN THE DISTILLATION SYSTEM TO SUPPLY THE LATENT HEAT OF VAPORIZATION TO THE DEAERATED FEEDWATER AND TO CONDENSE THE VAPOR FORMED BY ABSORBING THE SAME AMOUNT OF HEAT.

*DEAERATION + *VACUUM SYSTEMS + COMPONENT DESIGNS + DEAERATORS + DISTILLATION PROCESSES + PATENTS

30-00980 HERBERT LS + STERN S J
REMOVAL OF SCALE IN DISTILLATION OF SEA WATER CONTAINING MAGNESIUM SALTS
COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, EAST MELBOURNE, AUSTRALIA
U.S.PAT. 3,298,931 (1-15-63/1-17-67), 2 FIG, 15 REF

THE INVENTION PROVIDES A METHOD OF LOOSENING THE GELATINOUS SCALE WHICH FORMS ON THE INSIDE WALL OF AN EVAPORATOR TUBE DURING THE SPRAY EVAPORATION OF SEAWATER. STEAM IS PASSED THROUGH THE TUBE SO AS TO DRY OUT AND THUS LOOSEN THE SCALE. IF THE GASEOUS CARRIER USED FOR THE ENTRAINMENT OF THE LIQUID DROPLETS IS STEAM IT IS ONLY NECESSARY FOR THE FEEDWATER TO BE CUT OFF AT INTERVALS, THE STEAM USED AS CARRIER BEING ALLOWED TO CONTINUE TO PASS THROUGH THE TUBE. WHEN THE FEEDWATER IS AGAIN STARTED, THE LOOSENED SCALE IS FLUSHED OUT OF THE TUBE. FOR EXAMPLE, IN A 7-HR RUN THE FEEDWATER WAS CUT OFF FOR 1.5 MIN EVERY HOUR. OVER A PERIOD OF TIME THERE IS A SLOW BUILDUP OF A CRYSTALLINE SCALE WHICH IS RESISTANT TO THE STEAM DRYING TREATMENT. THIS ADHERENT SCALE CAN BE REMOVED BY THE INTRODUCTION OF A MINERAL ACID, A CHELATING AGENT, OR A SEQUESTERING AGENT.

*SCALE PREVENTION + *SCALE REMOVAL + CHEMICAL ADDITIVES + DIRECT CONTACT HEAT EXCHANGE + DISTILLATION PROCESSES + FEEDWATER TREATMENT + PATENTS + PHYSICAL CHEMISTRY OF SCALE + SCALING

30-00981 GEIRINGER PL + TAYLOR LT
TESTS TO PROVE PERFORMANCE OF HIGH TEMPERATURE WATER JET COMPRESSOR
AMERICAN HYDROTHERM CORP., NEW YORK
OSW R+D PROGR. REPT. NO.344 (APRIL 1968) 34 P, 19 FIG

THE DESIGN, CONSTRUCTION, AND TESTING OF A HIGH TEMPERATURE WATER JET COMPRESSOR TO PRODUCE NOT MORE THAN 1.3 LB OF COMPRESSED STEAM FOR EACH LB OF SUCTION STEAM USING SATURATED WATER AT 1010 PSIA AS A DRIVING MEDIUM WHEN COMPRESSING STEAM FROM 20.5 TO 25 PSIA. TEST RESULTS REPORTED SHOW THE ACTUAL PERFORMANCE WAS CONSIDERABLY BETTER THAN THE ABOVE. THE TESTS PROVED THAT USING 1010 PSIA SATURATED HIGH TEMPERATURE WATER, ONE LB OF SATURATED STEAM CAN BE COMPRESSED FROM 20.77 PSIA TO 25.46 PSIA, WHILE USING 0.757 LB OF HIGH TEMPERATURE WATER AND PRODUCING ONLY 1.26 LB OF EXCESS STEAM. THE CAPACITY OF THE TEST JET WAS 50,000 LB/HR OF SUCTION STEAM. IT IS EXPECTED THAT A FURTHER REDUCTION OF 10 TO 20% IN THE AMOUNT OF DRIVING FLUID REQUIRED CAN BE EXPECTED THROUGH A CONTINUATION OF THE TEST WORK.

*COMPRESSORS + *VAPOR COMPRESSION EVAPORATION + *VAPOR COMPRESSORS + COMPONENT DEVELOPMENT + DESIGN + DISTILLATION PROCESSES + OSW SPONSORED

30-00982 SALUTSKY ML + DUNSETH MG
RECOVERY OF TRACE ELEMENT CATIONS
W. R. GRACE AND CO., NEW YORK
U.S.PAT. 3,155,454 (11-21-62/11-3-64), 3 REF

A METHOD OF CONCENTRATING FROM SEAWATER OR BRINE CONCENTRATES TRACE ELEMENTS SUCH AS ALUMINUM BARIUM, CALCIUM, CADMIUM, CERIUM, COBALT, COPPER, IRON, LEAD, MANGANESE, NICKEL, SILVER, TIN, URANIUM, AND ZINC. THE SEAWATER IS PASSED THROUGH A BED OF MAGNESIUM AMMONIUM PHOSPHATE WHEREIN THE TRACE ELEMENTS REPLACE THE MAGNESIUM. THE TRACE ELEMENT AMMONIUM PHOSPHATE IS THEN TREATED TO RECOVER THE TRACE ELEMENTS. THE EFFLUENT SEAWATER IS THEN TREATED WITH PHOSPHORIC ACID OR SODIUM PHOSPHATE ALONG WITH AMMONIA TO PRECIPITATE MAGNESIUM AMMONIUM PHOSPHATE FOR USE IN THE TREATMENT COLUMN. THIS LATTER STEP IS COVERED IN OTHER PATENTS SUCH AS U.S.PAT. 3,042,606.

*CHEMICAL BY-PRODUCTS + *FEEDWATER TREATMENT + *SCALE PREVENTION + DISTILLATION PROCESSES + FERTILIZER + PATENTS

30-00983 HASSLER GL
MEANS AND METHOD FOR MASS AND HEAT TRANSFER
UNIVERSITY OF CALIFORNIA, BERKELEY
U.S.PAT. 3,129,145 (6-2-59/4-14-64), 5 FIG, 3 REF

THE INVENTION INVOLVES A STRUCTURE ADAPTED TO PROMOTE HEAT TRANSFER BETWEEN AN IMPERMEABLE WALL AND A BODY OF LIQUID FLOWING OVER THE SURFACE OF THE WALL OR HEAT AND MASS TRANSFER BETWEEN A BODY OF GAS AND A BODY OF LIQUID FLOWING IN CONTACT WITH THE GAS. FOR EXAMPLE, IN THE CASE OF HEAT TRANSFER THE INVENTION INVOLVES A POROUS LAYER ON AT LEAST ONE SURFACE OF THE WALL. LIQUID IS CONDUCTED IN SEQUENCE INTO CONTACT WITH THE SURFACE OF THE POROUS LAYER CONTACTING THE WALL THROUGH THE POROUS LAYER PARALLEL TO THE WALL AND THEN AWAY FROM THE SURFACE OF THE POROUS LAYER. A GAS

ACCESSION NUMBER 30-00978 TO 30-00983

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-00983 *CONTINUED*

PRESSURE IS MAINTAINED ON THE SURFACE OF THE POROUS LAYER REMOTE FROM THE WALL HIGHER THAN THE LIQUID PRESSURE IN THE POROUS LAYER. THE GAS PRESSURE IS ALSO SUFFICIENT TO CONTAIN THE LIQUID IN THE POROUS LAYER WHEN THE POROUS LAYER HAS A BODY OF LIQUID CONTACTING ITS SURFACE CONTACTING THE WALL. THUS, WHEN THE IMPERMEABLE WALL IS HEATED, SUCH HEAT IS READILY TRANSFERRED TO THE BODY OF FLUID DUE TO THE CONDUCTIVITY OF THE POROUS MATERIAL AND THE CONVECTIVE FLOW IN THE DIRECTION OF THE DESIRED HEAT TRANSFER, THAT IS, NORMAL TO THE WALL SURFACE. THE PRINCIPLE OF THE USE OF FLOW IN THIN CONDUCTING POROUS LAYERS CAN BE APPLIED IN LOW TEMPERATURE DIFFERENCE DISTILLATION AND/OR IN MASS TRANSFER WITH SMALL DIFFERENCES IN THE THERMO-DYNAMIC POTENTIAL.

*HEAT TRANSFER + *HEAT TRANSFER SURFACES + DISTILLATION PROCESSES +
EVAPORATOR-CONDENSER SYSTEM DESIGNS + HEAT TRANSFER IMPROVEMENTS + MASS TRANSFER + PATENTS

30-00984 EMMETT JR + MCGRATH J + CONNAUGHTON K
METHOD OF REDUCING THE SCALE FORMING ELEMENT ON SURFACES OF AN EVAPORATOR
WEIR WATER TREATMENT LIMITED, ENGLAND
U.S.PAT. 3,160,585 (8-31-61/12-8-64), 2 FIG, 4 REF

AN ION EXCHANGE METHOD FOR THE TREATMENT OF FEEDWATER TO REMOVE MAGNESIUM. THE FEEDWATER IS PASSED THROUGH AN ION EXCHANGE COLUMN CONTAINING THE SODIUM FORM OF A RESIN SUCH AS SULPHONATED POLYSTYRENE DIVINYLBENZENE. THE SODIUM REPLACES THE MAGNESIUM AND CONSEQUENTLY REDUCES THE SCALE FORMING CHARACTERISTICS OF THE FEEDWATER. THE RESIN IS REMOVED MECHANICALLY FROM THE BOTTOM OF THE COLUMN AND TRANSFERRED TO A REGENERATION COLUMN. THERE THE RESIN IS REGENERATED WITH CONCENTRATED BRINE WASTE FROM THE EVAPORATOR OF THE DISTILLATION PLANT. THE HIGH CONCENTRATION OF SODIUM IN THE WASTE BRINE REPLACES THE MAGNESIUM IN THE RESIN AND THE RESIN IS REMOVED FROM THE BOTTOM OF THE COLUMN AND RETURNED TO THE FEEDWATER TREATMENT COLUMN. THE ENTIRE PROCESS IS CONTINUOUS.

*FEEDWATER TREATMENT + *ION EXCHANGING + *REMOVAL FROM FEEDWATER, MAGNESIUM +
DISTILLATION PROCESSES + PATENTS + SCALE PREVENTION + SCALING

30-00985 EISENBERG DM + ALEXANDER LG + JOYNER JD + HOFFMAN HW + EBEL RA + NORITAKE HM + MORAN FJ
ENHANCED TUBES FOR SEAWATER DISTILLATION PLANTS
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
ORNL-TM-2611 (JULY 1969), 94 P. PREPRINTS OF ORNL PAPERS PRESENTED AT SYMP. ENHANCED TUBES FOR DESALINATION PLANTS, WASHINGTON, D.C., MAR. 1969.

THE MULTITUBE CONDENSER TEST FACILITY PROVIDED DATA ON HEAT TRANSFER CHARACTERISTICS OF A BUNDLE OF ENHANCED (ROPED SURFACE) HORIZONTAL STEAM CONDENSER TUBES, INCLUDING EFFECTS OF STEAM VELOCITY, NONCONDENSIBLE GASES, AND CONDENSATE INUNDATION. IN A SINGLE-TUBE TEST LOOP, VERTICAL-TUBE HEAT TRANSFER PERFORMANCE DATA WERE OBTAINED IN UP-FLOW AND DOWN-FLOW OPERATION WITH CONDENSATION ON THE OUTSIDE AND EVAPORATION ON THE INSIDE OF THE TUBES. BOTH DOUBLY FLUTED AND SPIRALLY CORRUGATED TUBES WERE TESTED OVER A RANGE OF TEMPERATURE, TEMPERATURE DIFFERENCE, LIQUID FLOW RATE, SALT CONCENTRATION, TUBE MATERIAL AND SURFACE CONDITION. IN A COMPUTER ANALYSIS OF THE USE OF ROPED TUBING WITH HEAT TRANSFER PERFORMANCE OF 1.3 TO 2.0 TIMES THAT OF SMOOTH TUBES, ECONOMIC EFFECTS WERE ESTIMATED IN TERMS OF MSF EVAPORATOR PLANT TUBING COSTS AND CONSTRUCTION COSTS. BREAK-EVEN COST FOR ENHANCED HEAT TRANSFER TUBING WITHOUT INCREASING COST OF PRODUCT WATER WAS ESTIMATED. FABRICATION OF HIGH PERFORMANCE CONDENSER TUBES WITH A ROPED CONFIGURATION CAN BE ACCOMPLISHED BY DRAWING SMOOTH TUBES THROUGH A ROTATING TOOL HEAD. A ROLLER-DIE TECHNIQUE CAN BE USED TO GENERATE A SPIRALLY CORRUGATED SURFACE ON 2-IN. OD EVAPORATOR TUBES, BUT HAS NOT, IN TESTS TO DATE, BEEN ABLE TO PRODUCE SATISFACTORY DOUBLY FLUTED TUBES. A MODIFIED THROUGH-FEED CYLINDRICAL THREAD-ROLLING MACHINE HAS BEEN USED FOR PRODUCTION OF DOUBLY FLUTED TUBES.

*FABRICATION METHODS + *HEAT TRANSFER IMPROVEMENTS + *HORIZONTAL TUBE EVAPORATORS +
*TUBING (METAL) + *VERTICAL TUBE EVAPORATORS + CAPITALIZED COSTS + CONDENSING + COPPER ALLOYS +
MULTISTAGE FLASH DISTILLATION + NONCONDENSABLE REMOVAL + OSW SPONSORED + TUBE BUNDLE DESIGN +
WELDING

30-00987 DUKLER AE + ELLIOTT LC
EXPERIMENTAL AND ANALYTICAL STUDIES OF HEAT TRANSFER IN A FALLING FILM SYSTEM
HOUSTON RESEARCH INSTITUTE, INC., TEXAS
OSW R+D PROGR. REPT. NO. 287 (OCT. 1967), 115 P, 42 FIG, 5 TABLES, 6 REF

ANALYSIS AND COMPARISON WITH THEORY ARE GIVEN FOR HEAT TRANSFER COEFFICIENTS ON THE CONDENSING SIDE. DATA IS FROM A SMOOTH 2-IN. X 20-FT TUBE WITH PRESSURES FROM 3.7 TO 65 IN. HG ABS. THE THEORY OF PREDICTING HEAT TRANSFER BY NUSSELT GAVE COEFFICIENTS WHICH ARE TOO LOW. THE THEORY BY DUKLER GAVE RESULTS WHICH AGREE QUITE WELL WITH THE DATA AND IS RECOMMENDED FOR DESIGN CALCULATIONS. EXPLANATIONS ARE PROPOSED TO EXPLAIN DIFFERENCES BETWEEN THEORY AND EXPERIMENT. THE EXPERIMENTAL EFFECT ON HEAT TRANSFER OF UP TO 6.6 VOL % AIR ON THE AIR SIDE IS GIVEN. THESE ARE COMPARED WITH AN EMPIRICAL RELATION BY MEISENBURG ET AL. AND THE THEORETICAL RELATION OF COLBURN AND HOUGEN. THE COLBURN-HOUGEN RELATION IS FAR BETTER - PREDICTIONS FOR THE CONDENSING SIDE ARE ABOUT 6% LOWER THAN THE EXPERIMENTAL RESULTS. DATA AND ANALYSIS FOR A SWIRL-TYPE INLET DEVICE SHOW NO EVIDENCE OF IMPROVED HEAT TRANSFER. A SUMMARY OF OBSERVATIONS OF THE INSIDE OF THE 2-IN. TUBE DURING HEAT TRANSFER UNDER VACUUM ARE GIVEN. SURFACE EVAPORATION WAS THE PREDOMINANT MECHANISM OF HEAT TRANSFER.

*FALLING FILM EVAPORATION + *HEAT TRANSFER + *HEAT TRANSFER COEFFICIENT + EVAPORATOR SYSTEM DESIGN +
EVAPORATORS + EXPERIMENTAL DATA + FILM EVAPORATION + HEAT TRANSFER IMPROVEMENTS +
NONCONDENSABLE REMOVAL + OSW SPONSORED + SPRAY NOZZLES

30-00988 LE GROS PG + MANDELLI EF + MCILHENNY WF + WINTHRODE DE + ZEITOUN MA
A STUDY OF THE DISPOSAL OF THE EFFLUENT FROM A LARGE DESALINATION PLANT
DOM CHEMICAL CO., MIDLAND, MICH. + TEXAS A+M, COLLEGE STATION
OSW R+D PROGR. REPT. NO. 316 (JAN. 1968), 491 P, 117 FIG, 442 REF
A COMPREHENSIVE LITERATURE SURVEY OF THE ECOLOGICAL AND LEGAL ASPECTS OF SITING LARGE

ACCESSION NUMBER 30-00983 TO 30-00988

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-00988 *CONTINUED*

DESALINATION PLANTS ALONG ONE OF THE COASTS OF THE U.S. THE STUDY INDICATES THAT EVEN UNDER THE MOST FAVORABLE CONDITIONS THE DISCHARGED EFFLUENTS WILL HAVE A DETECTABLE IMPACT ON LOCAL MARINE ENVIRONMENT. HEAT, SALT, AND CONCENTRATION OF COPPER IN THE DILUTED BRINE BLOWDOWN SEEM TO BE THE MOST CRITICAL PROPERTIES. AN ECONOMIC ANALYSIS WAS MADE OF THE EFFECTS FROM A PLANT LOCATED ON A HYPOTHETICAL BAY. PRELIMINARY DESIGNS OF INTAKE-OUTLETS WERE PREPARED AND COST ESTIMATES PREPARED.

*LITERATURE SURVEYS + *SEAWATER INTAKE AND DISCHARGE SYSTEMS + *THERMAL POLLUTION +
*WASTE DISPOSAL + PATENTS + SITE SELECTION CRITERIA

30-00989 PAVELIC F + GOELDNER RW

FLASH CHAMBER STRUCTURE

AQUA-CHEM, INC., WISCONSIN

U.S.PAT. 3,161,558 (7-5-60/12-15-64), 13 FIG, 16 REF

THE DESIGN OF A FLASH CHAMBER FOR MULTISTAGE FLASH EVAPORATION. IN EACH FLASH CHAMBER THERE IS LOCATED A PERFORATED PLATE SLOPING DOWNWARD (FROM 5 TO 45 DEG). THE PERFORATIONS ARE LOCATED ONLY IN THE PART OF THE PLATE NEAR THE BAFFLE THROUGH WHICH THE BRINE ENTERS THE CHAMBER. THE HEATED BRINE, FOR THE MOST PART, FLOWS UPWARD THROUGH THE HOLES IN THE PERFORATED PLATE AND SPREADS OUT AS A THIN FILM ON THE REMAINDER OF THE PLATE. THIS THIN FILM PERMITS RAPID EVAPORATION AND THE BOILING INCREASES AGITATION ON THE PLATE. THE UNEVAPORATED BRINE FLOWS UNDER A BAFFLE AND INTO THE NEXT FLASH CHAMBER.

*COMPONENT DESIGNS + *FLASH CHAMBERS + DISTILLATION PROCESSES + FILM BOILING + FLASH EVAPORATION +
MULTISTAGE FLASH DISTILLATION + PATENTS

30-00990 LOEBEL FA

APPARATUS FOR CONDUCTING FEED THROUGH FLASH EVAPORATORS

AQUA-CHEM, INC., WISCONSIN

U.S.PAT. 3,192,132 (6-20-60/6-29-65), 4 FIG, 5 REF

PROVISION IS MADE FOR THE ADDITION OF AN AGITATOR BLADE IN THE BRINE STREAM OF A MULTISTAGE FLASH EVAPORATOR SUCH AS DESCRIBED IN U.S. PAT. 3,161,558 (ABSTRACT 30-00989). THUS, RATHER THAN ALLOW ONLY THE TOP PORTION OF THE BRINE PASSING THROUGH THE FLASH CHAMBER TO BE EXPOSED TO THE LOW PRESSURE IN THE FLASH CHAMBER, ALL PORTIONS OF THE BRINE ARE EXPOSED TO THE LOW PRESSURE AT THE UPPER SURFACE OF THE LIQUID IN THE FLASH CHAMBER DURING SOME PORTION OF THE TIME IN WHICH THEY ARE FLOWING THROUGH THE FLASH CHAMBER.

*COMPONENT DESIGNS + *FLASH CHAMBERS + AGITATION + DISTILLATION PROCESSES + FILM BOILING +
FLASH EVAPORATION + MULTISTAGE FLASH DISTILLATION + PATENTS

30-00991 SCOTT RL

VACUUM DEAERATOR

FORREST L. MURDOCK, TULSA, OKLA.

U.S.PAT. 3,347,023 (10-24-65/10-17-67), 1 FIG, 4 REF

THE DESIGN OF A WATER DEAERATOR CONSISTING OF AN UPSTANDING CLOSED VESSEL HAVING A WATER OUTLET AT THE BOTTOM, A WATER INLET AND AN AIR OUTLET NEAR THE TOP, THE VESSEL HAVING TWO OR MORE SPACED HORIZONTAL PERFORATED DISTRIBUTION PANS SUPPORTED BETWEEN THE INTERIOR TOP AND BOTTOM. THE AREA ABOVE THE DISTRIBUTION PANS FORMS A WATER INLET AREA AND THE AREA BELOW THE DISTRIBUTION PANS FORMS A WATER STORAGE AREA. THE AREA BETWEEN THE PANS IS FILLED WITH DIFFUSING PACKING TO FORM PERCOLATION AREAS WITHIN THE VESSEL SO THAT WATER ENTERING THE VESSEL TRICKLES DOWNWARD THROUGH THE PERCOLATION AREAS. MEANS IS INCLUDED FOR APPLYING VACUUM TO THE VESSEL AT THE INLET OPENING SO THAT THE WATER IS DIFFUSED IN THE PERCOLATION AREA AND AS IT TRICKLES DOWNWARD IS SUBJECTED TO A VACUUM IN A MANNER SUCH THAT A SUBSTANTIAL PORTION OF ANY ENTRAINED OXYGEN, AIR, OR OTHER GASES IS EXTRACTED FROM THE WATER.

*COMPONENT DESIGNS + *DEAERATORS + CARBON DIOXIDE REMOVAL + COLUMNS (PROCESS) + DEAERATION +
DISTILLATION PROCESSES + FEEDWATER TREATMENT + PATENTS

30-00992 SILVERN DH

ROTARY EVAPORATOR-CONDENSER APPARATUS FOR THIN FILM DISTILLATION

U.S.PAT. 3,200,051 (9-14-61/8-10-65), 5 FIG, 4 REF

THE DESIGN OF APPARATUS WHICH INCLUDES A ROTARY EVAPORATOR-CONDENSER GENERALLY CONSISTING OF A HOUSING DIVIDED BY A PARTITIONING WALL INTO TWO CHAMBERS. ROTATABLY MOUNTED IN THE PARTITIONING WALL IS A CYLINDRICAL TUBULAR ROTOR CONSISTING OF A SERIES OF SPACED ANNULAR FINS IN A COAXIAL ALIGNMENT WHICH DEFINE A MULTIPLICITY OF RADially EXTENDING OPENINGS BETWEEN ADJACENT FINS, THE ROTOR BEING ROTATED SO THAT SEMI-CYLINDRICAL PORTIONS OF THE ROTOR EXTEND INTO BOTH CHAMBERS OF THE HOUSING. IN ONE CHAMBER EVAPORATION OF THE FEEDWATER TAKES PLACE WHILE IN THE OTHER CHAMBER VAPOR CONDENSATION OCCURS. THE EVAPORATION CHAMBER IS MAINTAINED AT ATMOSPHERIC PRESSURE AND SEAWATER FEED AT ABOUT 212 DEG F IS SPRAYED ON THE FINS. THE FINS ARE MAINTAINED AT ABOUT 217 DEG F SO THAT THE SEAWATER IS VAPORIZED. THE PORTION OF FEED WHICH DOES NOT VAPORIZE IS THROWN FROM THE FINS BY CENTRIFUGAL FORCE AND COLLECTS IN A SUMP AT THE BOTTOM OF THE CHAMBER. THE VAPOR IS REMOVED AND COMPRESSED TO RAISE ITS TEMPERATURE ABOVE THAT OF THE FINS. THIS SUPERHEATED VAPOR IS THEN INJECTED INTO THE CONDENSATION CHAMBER WHERE IT CONDENSES TO FORM PRODUCT WATER AND AT THE SAME TIME HEATS THE ROTATING FINS. THE CONDENSATE IS COLLECTED IN A SUMP AT THE BOTTOM OF THE CONDENSATION CHAMBER.

*ROTARY STILLS + *VAPOR COMPRESSION EVAPORATION + CENTRIFUGATION + COMPONENT DESIGNS +
DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + EVAPORATORS + FILM CONDENSATION +
FILM EVAPORATION + HEAT TRANSFER + PATENTS

30-00993 STURTEVANT HV

APPARATUS FOR DISTILLING WATER WITH WASTE HEAT

U.S.PAT. 3,203,875 (8-20-62/8-31-65), 2 FIG, 10 REF

THE DESCRIPTION OF A SYSTEM TO CONVERT IMPURE TO PURE WATER BY A DISTILLATION PROCEDURE

ACCESSION NUMBER 30-00988 TO 30-00993

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-00993 *CONTINUED*

WHICH UTILIZES WASTE HEAT FROM ABSORPTION TYPE AIR CONDITIONING EQUIPMENT. APPARATUS IS PROVIDED IN WHICH THE HEAT VALUES EVOLVED IN VARIOUS ELEMENTS OF THE AIR CONDITIONING UNITS ARE TRANSFERRED TO CIRCULATING IMPURE WATER WHICH IS THEN VAPORIZED. THE VAPORS ARE CONDENSED AND THE PURE WATER COLLECTED.

*HEAT RECOVERY + *SYSTEM DESCRIPTIONS + DISTILLATION PROCESSES + ENERGY SOURCES + HEAT RECOVERY SYSTEM + HEAT TRANSFER + PATENTS

30-00994 NEUGEBAUER FJ + LUSTENADER EL
DROPWISE CONDENSATION DISTILLATION APPARATUS
GENERAL ELECTRIC CO., NEW YORK

U.S.PAT. 3,206,381 (4-7-60/9-14-65), 5 FIG, 9 REF

A METHOD AND APPARATUS FOR DISTILLATION UTILIZING A WIPED FILM EVAPORATING SURFACE AND A DROPWISE CONDENSING SURFACE. THE CONDENSING SURFACE CONSISTS OF A SMOOTH SURFACE ORIENTED IN A VERTICAL DIRECTION AND MEANS FOR DRAINING MOUNTED ON THE SURFACE AT VARIOUS LEVELS TO COLLECT CONDENSED HEAT EXCHANGER VAPOR FROM THE SURFACE. THE DRAINING COLLECTORS ARE FABRICATED OF A MATERIAL WHICH IS NONWETTING WITH RESPECT TO THE CONDENSATE AND HAS SUFFICIENT VAPOR PRESSURE TO VAPORIZE IN THE HEAT EXCHANGE VAPOR. THE CONDENSING SURFACE IS PREFERENTIALLY WETTED BY CONDENSED NONWETTING MATERIAL RATHER THAN THE CONDENSED HEAT EXCHANGE VAPOR SO THAT UPON CONTACT WITH CONDENSING HEAT EXCHANGE VAPOR AND VAPORIZED NONWETTING MATERIAL THE SURFACE IS COATED WITH THE NONWETTING MATERIAL SO AS TO PROMOTE DROPWISE CONDENSATION.

*CONDENSATION PROMOTERS + *DROPWISE CONDENSATION + CHEMICAL ADDITIVES + CONDENSING + DISTILLATION PROCESSES + FILM EVAPORATION + HEAT TRANSFER IMPROVEMENTS + HEAT TRANSFER SURFACES + PATENTS + SYSTEM DESCRIPTIONS + WIPED FILM EVAPORATORS

30-00995 COLTON JW + MARGILOFF IB
FLASH VAPORIZATION DISTILLATION APPARATUS
HALCON INTERNATIONAL, INC., DELAWARE

U.S.PAT. 3,207,677 (9-22-60/9-21-65), 2 FIG, 13 REF

A PROCESS FOR PASSING SENSIBLE HEAT FROM A FIRST MATERIAL TO A SECOND MATERIAL IN A SEMI-DIRECT MANNER, MORE PARTICULARLY TO SUCH A PROCESS WHEREIN AT LEAST ONE COMPONENT IS VAPORIZED FROM THE FIRST MATERIAL AND THE RESULTING VAPOR IS CONTACTED WITH AND CONDENSED ON THE SECOND MATERIAL, AND ESPECIALLY TO SUCH PROCESSES WHEREIN BOTH MATERIALS ARE LIQUIDS AND THE VAPOR IS CONTACTED WITH THE SECOND MATERIAL IN A COUNTER-CURRENT MANNER AND SUBSTANTIALLY ADIABATICALLY. ALSO THE APPARATUS FOR USE IN CARRYING OUT SUCH PROCESSES, AND ESPECIALLY TO SUCH APPARATUS INCLUDING A SERIES OF EVAPORATIVE COOLING ZONES ARRANGED TO OPERATE AT PROGRESSIVELY LOWER PRESSURES, EACH SUCH ZONE BEING IN VAPOR CONTACT WITH A SERIES OF CONDENSATION WARMING ZONES ARRANGED TO OPERATE AT PROGRESSIVELY LOWER PRESSURES.

*DIRECT CONTACT HEAT EXCHANGE + *HEAT TRANSFER + *SYSTEM DESCRIPTIONS + CONDENSERS + DISTILLATION PROCESSES + EVAPORATORS + FLASH EVAPORATION + PATENTS

30-00996 HOGAN WH + HICKMAN KCD
THERMAL COMPRESSION STILL
AQUASTILLS INCORPORATED, ROCHESTER, N. Y.

U.S.PAT. 3,200,050 (4-14-60/8-10-65), 7 FIG, 11 REF

THE DESIGN OF A ROTARY VAPOR COMPRESSION STILL OF THE TYPE DESCRIBED IN U.S.PAT. 2,734,023 (ABSTRACT 30-00707). THIS INVENTION PROVIDES IN A COMPRESSION STILL, A PHASE SEPARATION BARRIER AND HEAT EXCHANGER HAVING AN INTEGRAL COMPRESSOR AND DRIVEN AT A HIGHER SPEED THAN THE BARRIER AND HEAT EXCHANGER. IT ALSO COVERS A STILL HAVING A ROTARY PHASE SEPARATION BARRIER AND HEAT EXCHANGER CONSISTING OF A STACK OF ANNULAR EVAPORATING AND CONDENSING SURFACES WITH AN INTEGRAL CONDENSING CHAMBER AND COMPRESSOR. ALSO THERE CAN BE PROVIDED A PHASE SEPARATION BARRIER AND HEAT EXCHANGER INCORPORATING A STACK OF HEAT EXCHANGE SURFACES IN WHICH STEAM IS FED TO THE CONDENSING SURFACES THROUGH CHANNELS BETWEEN THE OUTER AND INNER PERIPHERIES OF THE STACK.

*COMPONENT DESIGNS + *ROTARY STILLS + *VAPOR COMPRESSION EVAPORATION + CENTRIFUGATION + DISTILLATION PROCESSES + EVAPORATORS + FILM CONDENSATION + FILM EVAPORATION + HEAT TRANSFER + PATENTS

30-00997 KELLER E
OSCILLATORY ROTOR BLADE FOR TREATMENT OF FLUENT MATERIAL IN THIN LAYERS
LUWA A.G., ZURICH, SWITZERLAND

U.S.PAT. 3,199,575 (10-31-62/8-10-65), 14 FIG, 4 REF

THE DESIGN OF A WIPED FILM, FALLING FILM TYPE OF EVAPORATOR. THE APPARATUS CONSISTS OF THE USUAL TUBULAR PROCESS CHAMBER FITTED WITH A ROTOR STRUCTURE INCORPORATING OSCILLATORY ROTOR BLADES FOR DISTRIBUTING THE LIQUID LAYER ON THE INNER TREATING SURFACE OF THE TUBULAR PROCESS CHAMBER. THE OSCILLATORY BLADE ELEMENTS ARE HINGED TO ASSUME A RADIAL POSITION AT NEGLIGIBLE CLEARANCE WITH RESPECT TO THE TREATING SURFACE WHEN NO LIQUID IS IN THE PROCESS CHAMBER. THIS OSCILLATORY ARRANGEMENT OF THE BLADE ELEMENTS SUBSTANTIALLY ELIMINATES ANY RADIAL PRESSURE EFFECT ON THE LIQUID, AND CAUSES A THIN LAYER SPREADING OF THE LIQUID AT MINIMAL CLEARANCE AND WITH A HIGH TURBULENCE. ALSO, BECAUSE THE BLADE ELEMENTS ARE ARRANGED FOR OSCILLATORY MOVEMENT, IT IS NOT NECESSARY TO MAINTAIN THE EXTENT OF CLEARANCE FROM THE TREATING SURFACE THAT IS NORMALLY NECESSARY IN WIPER BLADE EVAPORATORS.

*WIPED FILM EVAPORATORS + COMPONENT DESIGNS + DISTILLATION PROCESSES + EVAPORATORS + FALLING FILM EVAPORATION + FILM EVAPORATION + PATENTS + ROTARY STILLS

30-00998 KELLER E
FALLING FILM-EVAPORATORS AND ROTOR STRUCTURE THEREFOR
LUWA A.G., ZURICH, SWITZERLAND

U.S.PAT. 3,199,574 (11-14-60/8-10-65), 4 FIG, 7 REF

THE DESIGN OF A WIPED FILM, FALLING FILM TYPE OF EVAPORATOR. THE EVAPORATOR CONSISTS

ACCESSION NUMBER 30-00993 TO 30-00998

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-00998 *CONTINUED*

OF A VERTICAL TUBULAR SHELL WITHIN WHICH IS LOCATED WIPER BLADES ROTATING ON A VERTICAL AXIS. THE EVAPORATOR IS PROVIDED WITH THE FEATURE THAT IN THE REGION OF THE WALL OF THE HOUSING WHERE THE LARGER THICKNESS OF THE LAYER OF MATERIAL TO BE PROCESSED APPEARS, THE ROTOR BLADES ARE RIGIDLY CONSTRUCTED AND SPACED FROM THE WALL OF THE HOUSING, WHEREAS THE VANES LOCATED IN THE LOWER SECTION OF THE HOUSING WHERE THERE APPEARS A SMALLER THICKNESS OF THE FLUID LAYERS ARE CONSTRUCTED SO AS TO BE RELATIVELY MOVABLE AND ARE ADAPTED TO BE DRIVEN TOWARD THE WALL OF THE HOUSING BY THE CENTRIFUGAL FORCE OF ROTATION.

*WIPED FILM EVAPORATORS + COMPONENT DESIGNS + DISTILLATION PROCESSES + EVAPORATORS + FALLING FILM EVAPORATION + FILM EVAPORATION + PATENTS + ROTARY STILLS

30-00999 LAWRENCE HR

MULTI-STAGE FLASH EVAPORATORS

BALDWIN-LIMA-HAMILTON CORP., PHILADELPHIA

U.S.PAT. 3,197,387 (5-20-63/7-27-65), 7 FIG, 5 REF

THE DESIGN OF A FLASH CHAMBER FOR A MULTISTAGE FLASH EVAPORATOR WHICH INCLUDES DIVIDING THE BRINE SECTION OF THE CHAMBER INTO AN ENTRANCE SECTION AND A RISER SECTION. SEPARATION OF THE FLASHING VAPOR FROM THE BRINE IS ACHIEVED BY FLASHING THE LIQUID ONLY IN THE RISER CHAMBER CAUSING A GAS LIFT EFFECT IN THE RISER CHAMBER AND LIFTING THE LIQUID-VAPOR MIXTURE OVER THE SIDE WALLS OF THE RISER CHAMBER TO ALLOW IT TO FREE FALL INTO A SEPARATE PART OF THE EVAPORATOR CHAMBER. DURING THE FREE FALL, THERE IS NO HYDROSTATIC PRESSURE ON THE LIQUID-VAPOR MIXTURE AND THE VAPOR COMPLETELY SEPARATES FROM THE LIQUID. ENTRAINED LIQUID DROPLETS ARE SEPARATED FROM THE VAPOR BY FORCING THE VAPORS TO PASS THROUGH A MIST ELIMINATOR BEFORE THEY CAN REACH THE CONDENSER.

*COMPONENT DESIGNS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + *FLASH CHAMBERS + BAFFLES + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + FLASH EVAPORATION + MULTISTAGE FLASH DISTILLATION + PATENTS

30-01000 LOEBEL FA + LEITNER GF

MULTI-STAGE FLASH EVAPORATOR WITH REMOVABLE STAGES

AQUA-CHEM, INC., WISCONSIN

U.S.PAT. 3,192,131 (6-20-60/6-29-65), 7 FIG, 16 REF

THE DESIGN OF A LONG TUBE MULTISTAGE FLASH EVAPORATOR UNIT PARTICULARLY SUITABLE FOR EASE OF CONSTRUCTION IN SMALL SIZES. THE UNIT IS DESIGNED SO THAT THE INTERNAL STRUCTURE CONSISTING OF THE INTERSTAGE BAFFLES, LONG CONDENSER TUBES, PRODUCT TRAYS, ETC. CAN BE CONSTRUCTED AS AN ASSEMBLY AND THEN INSERTED INTO AN EXTERNAL SHELL.

*COMPONENT DESIGNS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + *FABRICATION METHODS + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + FLASH CHAMBERS + FLASH EVAPORATION + HORIZONTAL TUBE CONDENSERS + MULTISTAGE FLASH DISTILLATION + PATENTS + TUBE BUNDLE DESIGN

30-01001 LOEBEL FA

VAPOR COMPRESSION STILL FOR DISTILLING IMPURE WATER

AQUA-CHEM, INC., WIS.

U.S.PAT. 3,311,543 (5-15-63/3-28-67), 3 FIG, 8 REF

METHODS AND APPARATUS FOR USING A REFRIGERATION CYCLE IN A DISTILLATION PROCESS TO PROVIDE HOT AND/OR PURE WATER PRODUCT. THE SYSTEM MAY BE ADAPTED FOR CONTROL FOR PRODUCTION OF HOT OR COLD WATER WITH THE HEATING MEANS FOR HEATING THE VAPORIZATION ZONE BEING USED TO HEAT THE HOT PRODUCT WATER AND THE COOLING MEANS FOR COOLING THE CONDENSATION ZONE MAY BE USED TO COOL COLD PRODUCT WATER. IN ONE FORM, REFRIGERANT IS USED TO HEAT THE VAPORIZATION ZONE AND COOL THE CONDENSATION ZONE, THE REFRIGERANT BEING COMPRESSED PRIOR TO PASSAGE IN HEAT EXCHANGE WITH THE VAPORIZATION ZONE AND BEING EXPANDED OR VAPORIZED PRIOR TO PASSAGE IN HEAT EXCHANGE WITH THE CONDENSING ZONE. THE REFRIGERANT IS DIVERTED THROUGH PRODUCT WATER AFTER COMPRESSION TO HEAT PRODUCT WATER AND MAY ALSO BE DIVERTED THROUGH PRODUCT WATER AFTER EXPANSION TO COOL THE PRODUCT WATER.

DISTILLATION PROCESSES + HEAT TRANSFER + PATENTS + SYSTEM DESCRIPTIONS

30-01002 GLUECKAUF E

PROCESS AND APPARATUS FOR DESALINATION OF AN AQUEOUS SOLUTION CONTAINING CALCIUM SULPHATE

U.K. ATOMIC ENERGY AUTHORITY, LONDON

U.S.PAT. 3,377,273 (2-14-66/4-9-68), 2 FIG, 5 REF

A PROCESS AND APPARATUS FOR THE DESALINATION OF SEAWATER CONTAINING CALCIUM SULPHATE BY REDUCING THE CONCENTRATION OF CALCIUM SULPHATE AND DISTILLING THE SOLUTION. THE CALCIUM SULPHATE CONCENTRATION IS REDUCED BY HEATING THE SEAWATER TO A TEMPERATURE (113 TO 167 DEG C) AT WHICH THE CONCENTRATION OF CALCIUM SULPHATE IN THE SOLUTION EXCEEDS THE SOLUBILITY OF ANHYDROUS CALCIUM SULPHATE BUT IS LESS THAN THE SOLUBILITY OF CALCIUM SULPHATE HEMIHYDRATE. THE HEATED SEAWATER IS PASSED THROUGH A BED OF ANHYDROUS CALCIUM SULPHATE PRIOR TO DISTILLATION.

*FEEDWATER TREATMENT + *SCALE PREVENTION + DISTILLATION PROCESSES + PATENTS + REMOVAL FROM FEEDWATER, CALCIUM + SYSTEM DESCRIPTIONS

30-01003 DUNSETH MG + SALUTSKY ML

PROCESS FOR DESCALING SEA WATER

W. R. GRACE AND CO., NEW YORK

U.S.PAT. 3,167,505 (9-7-62/1-26-65), 2 REF

THE SCALING CONSTITUENTS OF SEAWATER FEED ARE REMOVED BY FIRST SATURATING A PORTION OF THE FEEDWATER (3 TO 40%) WITH CALCIUM PHOSPHATE BY PASSING THE PORTION OF THE FEEDWATER THROUGH NORMAL SUPERPHOSPHATE OR TRIPLE SUPERPHOSPHATE. THIS SATURATED SOLUTION IS PASSED THROUGH A STRONGLY ACIDIC CATION EXCHANGE RESIN IN THE SODIUM FORM. THE EFFLUENT IS RECOVERED AND ADDED TO THE BULK OF THE UNTREATED FEEDWATER WITH A SUITABLE QUANTITY OF AMMONIA TO PRECIPITATE SCALE FORMING METALLIC CATIONS AS METAL PHOSPHATES. THIS FORMS THE DESCALED SEAWATER FOR FEED. THE EXCHANGE RESIN IS REGENERATED WITH A SOLUTION CONTAINING AT LEAST 6% SODIUM CHLORIDE SUCH AS MAY BE

ACCESSION NUMBER 30-00998 TO 30-01003

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01003 *CONTINUED*

OBTAINED FROM DESALTING EVAPORATOR WASTE SOLUTION.
 *FEEDWATER TREATMENT + *SCALE PREVENTION + CHEMICAL ADDITIVES + CHEMICAL BY-PRODUCTS +
 DEMINERALIZERS + DISTILLATION PROCESSES + ION EXCHANGING + PATENTS + SCALING

30-01004 NEUGEBAUER FJ + LUSTENADER EL

COMPRESSION DISTILLATION APPARATUS

GENERAL ELECTRIC CO., NEW YORK

U.S.PAT. 3,190,817 (12-26-57/6-22-65), 22 FIG, 14 REF

APPARATUS FOR THE VAPOR COMPRESSION DISTILLATION OF SEAWATER. THE EVAPORATION SURFACE IS A SIMPLE CYLINDER AND OPERATES NEAR ATMOSPHERIC PRESSURE OR UNDER VACUUM. THE INNER SURFACE OF THE CYLINDER IS WIPED BY A BLADE ROTATING ABOUT THE INNER SURFACE AT 10 TO 100 RPM. THIS WIPER SERVES TO DISTRIBUTE THE FEEDWATER OVER THE SURFACE IN A FILM, THE THICKNESS OF WHICH MAY BE ADJUSTED TO PROVIDE THE BEST OPERATION. IT IS DESIRABLE THAT THE FILM ON THE INNER SURFACE ALMOST COMPLETELY DRIES BEFORE THE NEXT WIPING BY THE BLADE. DROPPWISE CONDENSATION ON THE OUTSIDE OF THE CYLINDER CAN BE PROMOTED BY THE WIPING ACTION OF A NONWETTING SURFACE SUCH AS TEFLON. VAPOR FROM THE INSIDE OF THE CYLINDER IS COMPRESSED AND USED TO HEAT THE OUTSIDE OF THE CYLINDER.

*VAPOR COMPRESSION EVAPORATION + *WIPE FILM EVAPORATORS + COMPONENT DESIGNS +
 CONDENSATION PROMOTERS + DROPPWISE CONDENSATION + EVAPORATOR SYSTEM DESIGN + FILM EVAPORATION +
 PATENTS + ROTARY STILLS

30-01005 WILLIAMSON WR

SEA WATER DISTILLATION METHOD AND APPARATUS TO PROVIDE A SUPERPURE DISTILLATE

AMERICAN MACHINE AND FOUNDRY CO., NEW YORK

U.S.PAT. 3,183,174 (5-6-58/5-11-65), 1 FIG, 18 REF

APPARATUS AND METHOD FOR PRODUCING BOTH POTABLE WATER AND SUPERPURE WATER SUITABLE FOR BOILER FEED FROM SEAWATER. THE EVAPORATOR RECEIVES SEAWATER FROM WHICH A DISTILLATE IS TO BE PRODUCED AND IT ALSO RECEIVES STEAM FOR OUT-OF-CONTACT HEAT TRANSFER TO PRODUCE VAPORS WHICH ARE DIRECTED FROM THE EVAPORATOR TO THE CONDENSER WHEREIN AT LEAST SOME OF THE VAPORS ARE CONDENSED TO PROVIDE A POTABLE WATER. THE SEAWATER IS PUMPED THROUGH THE CONDENSER IN OUT-OF-CONTACT HEAT TRANSFER WITH THE VAPORS WHEREBY THE SEAWATER IS PREHEATED BEFORE INTRODUCTION TO THE EVAPORATOR. THE HEATING STEAM IS SUPPLIED VIA A STEAM EJECTOR AND SOME OF THE VAPOR PRODUCED IN THE EVAPORATOR IS RECIRCULATED WITH THE HEAT PRODUCING STEAM BY BEING DRAWN IN BY THE EJECTOR. THIS COMBINED STEAM FLOW HEATS THE EVAPORATOR WHEREIN IT IS CONDENSED TO PRODUCE THE SUPERPURE WATER FOR MAKE-UP FEED FOR THE BOILER.

*EVAPORATOR-CONDENSER SYSTEM DESIGNS + *SYSTEM DESCRIPTIONS + COMPONENT DESIGNS +
 DISTILLATION PROCESSES + HEAT EXCHANGERS + PATENTS + PRODUCT WATER PURITY + STEAM JET EJECTORS

30-01006 CHIRICO AN

MULTI-STAGE FLASH EVAPORATION SYSTEM

CHICAGO BRIDGE AND IRON CO., CHICAGO

U.S.PAT. 3,180,805 (9-1-61/4-27-65), 2 FIG, 5 REF

A SYSTEM TO REDUCE THE DELETERIOUS EFFECT OF VAPOR LEAKAGE AROUND THE CONDENSER TUBES WHEN THEY PASS THROUGH THE CHAMBER SEPARATORS IN A MULTISTAGE FLASH DISTILLATION PLANT. IN THE SYSTEM DESCRIBED, TWO PARALLEL FLASH CHAMBER SEPARATING PLATES ARE USED AND VAPOR WHICH LEAKS AROUND THE CONDENSER TUBES FLOWS INTO THIS SPACE. VAPOR FROM THIS SPACE IS PIPED TO A STAGE OF LOWER PRESSURE WHERE ANY CONDENSABLE VAPOR CONDENSES AND NONCONDENSIBLES CAN FLOW TO THE NEXT STAGE. EVENTUALLY THE NONCONDENSABLE GASES REACH THE STAGE OF LOWEST PRESSURE IN THE SYSTEM AND ARE EXHAUSTED BY A PUMP.

*EVAPORATOR-CONDENSER SYSTEM DESIGNS + *INTERSTAGE SEALS + *NONCONDENSABLE REMOVAL +
 COMPONENT DESIGNS + CONDENSERS + DISTILLATION PROCESSES + FLASH EVAPORATION +
 HORIZONTAL TUBE CONDENSERS + MULTISTAGE FLASH DISTILLATION + PATENTS

30-01007 HOLTSLAG D

FALLING FILM EVAPORATOR

GENERAL ELECTRIC CO., NEW YORK

U.S.PAT. 3,175,962 (2-28-61/3-30-65), 9 FIG, 9 REF

THE DESIGN OF A VERTICAL TUBE, FALLING FILM EVAPORATOR IN WHICH THE TUBES OR VERTICAL EVAPORATING PLATES ARE TAPERED FROM TOP TO BOTTOM SO AS TO PROVIDE REDUCED VAPOR PASSAGE SPACE NEAR THE TOP OF THE TUBES. THIS REDUCED SPACE RESULTS IN INCREASED VAPOR VELOCITY AND MAINTAINS A TURBULENT LIQUID FILM ON THE TUBE SURFACE. THE TUBES MAY BE FLUTED ON THE EXTERIOR SURFACE TO AID IN THE CONDENSATION AND HEAT TRANSFER OF THE STEAM USED AS A HEAT SOURCE.

*EVAPORATOR-CONDENSER TUBES + *FALLING FILM EVAPORATION + *VERTICAL TUBE EVAPORATORS +
 COMPONENT DESIGNS + DISTILLATION PROCESSES + EVAPORATORS + EXTENDED HEAT TRANSFER SURFACES +
 FILM EVAPORATION + HEAT TRANSFER IMPROVEMENTS + HEAT TRANSFER SURFACES + PATENTS

30-01008 WORTHEN EP + BARBOUR FS

TANDEM FLASH DISTILLING PLANT

BETHLEHEM STEEL CO., PA.

U.S.PAT. 3,174,914 (1-19-59/3-23-65), 4 FIG, 12 REF

THE DESIGN OF A MULTISTAGE FLASH DISTILLATION PLANT CONSISTING OF A NUMBER OF STAGES LOCATED END-TO-END IN A SINGLE CONTINUOUS SHELL. CONDENSING MEANS FOR THE FLASHED VAPORS OF EACH STAGE ARE PROVIDED BY A NUMBER OF TUBES CONTINUOUS THROUGHOUT THE LENGTH OF THE SHELL AND PASSING THROUGH THE PARTITION WALLS SEPARATING ADJACENT STAGES. TAPERED FEED DUCTS ARE PROVIDED SO THAT AT ANY POINT ALONG THE LONGITUDINAL DIMENSIONS OF A STAGE ADEQUATE CROSS-SECTIONAL FLOW AREA IS ASSURED FOR THE FEED TO BE FLASHED AS WELL AS FOR THE EXCESS FEED OF THE PARTICULAR STAGE.

*COMPONENT DESIGNS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + BRINE FLOW + DESIGN +
 DISTILLATION PROCESSES + FLASH EVAPORATION + FLOW CONTROL + HORIZONTAL TUBE CONDENSERS +
 MULTISTAGE FLASH DISTILLATION + PATENTS

ACCESSION NUMBER 30-01003 TO 30-01008

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01009 MULFORD SF
EVAPORATOR CONSTRUCTION

BALDWIN-LIMA-HAMILTON CORP., PHILADELPHIA

U.S.PAT. 3,172,824 (4-25-61/3-9-65), 11 FIG, 8 REF

THE DESIGN OF AN INTERSTAGE SEAL BETWEEN THE FLASH CHAMBERS OF A MULTISTAGE FLASH EVAPORATOR. THE STAGES OF THE EVAPORATOR ARE SEPARATED BY VERTICAL PLATES OPEN AT THE BOTTOM TO PERMIT THE PASSAGE OF BRINE. IN EACH STAGE, AT THE INLET TO THE STAGE, THERE IS LOCATED A VERTICAL BAFFLE FROM THE BOTTOM OF THE CHAMBER UP PART WAY INTO THE CHAMBER HIGHER THAN THE OPENING IN THE BOTTOM OF THE STAGE SEPARATOR. A VARIABLE ADJUSTABLE ORIFICE IS PROVIDED TO RESTRICT THE FLOW THROUGH THE OPENING IN THE BOTTOM OF THE STAGE SEPARATORS WHEN NEEDED TO MAINTAIN A SEAL.

*COMPONENT DESIGNS + *EVAPORATORS + *INTERSTAGE SEALS + *ORIFICES + BAFFLES + BRINE FLOW + DESIGN + DISTILLATION PROCESSES + FLASH CHAMBERS + FLASH EVAPORATION + FLOW CONTROL + MULTISTAGE FLASH DISTILLATION + PATENTS

30-01010 WILLIAMS A
SUBMERGED COMBUSTION AND FLASH EVAPORATION SYSTEM AND PROCESS

SUBMERGED COMBUSTION, INC., HAMMOND, IND.

U.S.PAT. 3,165,452 (6-15-59/1-12-65), 1 FIG, 6 REF

A NEW AND IMPROVED EVAPORATOR AND METHOD FOR THE EVAPORATION OF LIQUIDS. THE APPARATUS CONSISTS OF (1) A HEATING UNIT IN WHICH THE LIQUID TO BE EVAPORATED IS LOCATED AND WHICH IS PROVIDED WITH A SUBMERGED COMBUSTION BURNER IN WHICH THE FLAME OF THE BURNER BURNS IN DIRECT CONTACT WITH THE LIQUID BENEATH THE LIQUID LEVEL, (2) MEANS FOR REMOVING UNDISSOLVED COMBUSTION GASES FROM THE HEATING ZONE, (3) MEANS TO TRANSFER THE HOT LIQUID DIRECTLY FROM THE HEATING UNIT TO A SERIES OF FLASH EVAPORATORS WHERE PART OF THE LIQUID FLASHES INTO VAPOR, (4) MEANS TO TRANSFER THE FLASHED VAPORS FROM ABOVE THE LIQUID TO CONDENSERS, (5) MEANS TO RECOVER THE CONDENSATE, AND (6) MEANS TO REMOVE THE RESIDUAL LIQUID FROM THE LAST EVAPORATOR IN THE SERIES. IN OPERATION, THE FEEDWATER TO THE BURNER UNIT IS PASSED THROUGH THE CONDENSERS BEFORE IT IS INTRODUCED INTO THE BURNER UNIT, COOLING THE VAPORS FROM THE FLASH EVAPORATOR WHILE PREHEATING THE FEEDWATER. A STRIPPING TOWER IS PROVIDED TO REMOVE NONCONDENSIBLE GASES FROM THE BURNER UNIT.

*DIRECT CONTACT HEAT EXCHANGE + *EVAPORATOR SYSTEM DESIGN + COMPONENT DESIGNS + DISTILLATION PROCESSES + EVAPORATORS + FLASH EVAPORATION + FLOWSHEETS + PATENTS

30-01011 SALUTSKY ML + DUNSETH MG
PROCESS OF DESCALING SEAWATER

W. R. GRACE AND CO., NEW YORK

U.S.PAT. 3,163,599 (1-21-63/12-29-64), 1 FIG, 2 REF

A CYCLIC PROCESS FOR THE PRODUCTION OF CHLORINE AND METAL PHOSPHATE FERTILIZER MATERIALS FROM SEAWATER AND FOR THE DESCALING OF SEAWATER FOR EVAPORATOR FEED. WASTE, DESCALING SEAWATER OR CONCENTRATED WASTE BRINE IS FIRST ELECTROLYZED IN A SUITABLE ELECTROLYTIC CELL. CHLORINE GAS IS COLLECTED AT ONE ELECTRODE AND HYDROGEN AT THE OTHER, LEAVING BEHIND, AS THE CELL LIQUOR, DILUTE SOLUTION OF SODIUM HYDROXIDE AND SODIUM CHLORIDE. THEN PHOSPHORIC ACID IS ADDED TO THE CELL LIQUOR UNTIL ALL OF THE SODIUM HYDROXIDE HAS BEEN CONVERTED TO DISODIUM PHOSPHATE. THE RESULTING MIXTURE OF DISODIUM PHOSPHATE AND SODIUM CHLORIDE IS THEN ADDED DIRECTLY TO A SUITABLE QUANTITY OF SEAWATER FEED, ALONG WITH AMMONIA, TO PRECIPITATE CALCIUM PHOSPHATE AND METAL AMMONIUM PHOSPHATES. THE DESCALING WATER IS THEN SUITABLE FOR EVAPORATOR FEED. A FEW PERCENT OF THE RESIDUAL CONCENTRATED DESCALING BRINE LEFT IN THE EVAPORATOR IS RETURNED TO THE ELECTROLYTIC CELL TO BECOME THE STARTING MATERIAL FOR THE NEXT CYCLE. THE ACTUAL QUANTITY WILL DEPEND UPON THE CONCENTRATION OF THE ORIGINAL CALCIUM AND MAGNESIUM TO BE REMOVED.

*FEEDWATER TREATMENT + *SCALE PREVENTION + CHEMICAL ADDITIVES + CHEMICAL BY-PRODUCTS + CHEMICAL PRODUCTION + DISTILLATION PROCESSES + FERTILIZER + FLOWSHEETS + PATENTS + REMOVAL FROM FEEDWATER, CALCIUM + REMOVAL FROM FEEDWATER, MAGNESIUM

30-01012 CHAMPE WF
DISTILLATION APPARATUS FOR CONVERTING SALT WATER INTO FRESH WATER

U.S.PAT. 3,163,587 (12-13-60/12-29-64), 4 FIG, 16 REF

APPARATUS CONSISTING OF AN OUTER STATIONARY HOUSING, A ROTATING DRUM WITHIN THE HOUSING, A SPRAY NOZZLE FOR SEAWATER FEED INSIDE THE DRUM, AN INCLINED CONDENSER, A DEMISTING PLATE IN THE VAPOR OUTLET FROM THE DRUM, AND A PUMP FOR SEAWATER FEED. THE MOTOR FOR ROTATING THE DRUM IS WATER COOLED, THE HEAT GOING TO THE SEAWATER FEED STREAM. THE DRUM IS HEATED EXTERNALLY WITH ELECTRICITY, GAS, OIL, OR COAL FLAME. THE SPRAY IS VAPORIZED IMMEDIATELY ON CONTACT WITH THE SURFACES OF THE HEATED ROTATING DRUM AND MOST OF THE SALT DEPOSITS ON THE INSIDE SURFACE OF THE DRUM. A SCRAPER LOCATED INSIDE THE DRUM REMOVES THE SALT AND ALLOWS IT TO FALL TO THE BOTTOM OF THE HOUSING WHERE IT COLLECTS AND IS REMOVED.

*FILM EVAPORATION + *ROTARY STILLs + COMPONENT DESIGNS + DISTILLATION PROCESSES + PATENTS + SPRAY NOZZLES

30-01013 DENKER BL + LORENZINI RA
APPARATUS FOR DISTILLATION OF SALINE WATER TO PRODUCE FRESH WATER

FOSTER WHEELER CORP., NEW YORK

U.S.PAT. 3,210,260 (5-14-62/10-5-65), 2 FIG, 17 REF

APPARATUS AND METHOD FOR THE DISTILLATION OF SALINE WATER UTILIZING A HEAT EXCHANGER WITH A MOVABLE REGENERATIVE MASS. HEAT IS SUPPLIED BY HOT EXHAUST GASES AS FOUND IN THE PROCESS INDUSTRY. THE APPARATUS CONSISTS OF AN ENDLESS METALLIC BELT PASSING THROUGH A HEATING ZONE AND AN EVAPORATION ZONE. IN THE HEATING ZONE, HOT EXHAUST GASES HEATS THE BELT. IN THE EVAPORATION ZONE, PREHEATED SALINE WATER IS SPRAYED ONTO THE BELT FORMING PURE VAPOR. THE VAPOR IS DIRECTED TO AN EXTERNAL CONDENSER WHEREIN IT IS CONDENSED TO FORM PRODUCT WATER. SEAWATER IS USED TO COOL THE CONDENSER AND AT THE SAME TIME IS PREHEATED TO BE USED AS FEEDWATER TO THE EVAPORATOR.

ACCESSION NUMBER 30-01009 TO 30-01013

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01013 *CONTINUED*

*HEAT RECOVERY + *WASTE HEAT BOILERS + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + EVAPORATORS + HEAT TRANSFER + PATENTS + SYSTEM DESCRIPTIONS

30-01014 ROSENBLAD AE

FALLING FILM EVAPORATOR

ROSENBLAD CORP., PRINCETON, N.J.

U.S.PAT. 3,366,158 (5-12-66/1-30-68), 5 FIG, 5 REF

THE DESIGN OF A FALLING FILM TYPE EVAPORATOR CONSISTING OF A NUMBER OF VERTICAL, PARALLEL, TWO-PLATE HOLLOW HEATING ELEMENTS LOCATED IN A ROW EXTENDING PERPENDICULARLY TO THE PARALLEL HEATING PLANES OF THE PLATES. THE HEATING ELEMENTS HAVE THEIR OUTER HEATING SURFACES EXTENDING STRAIGHT VERTICALLY TO PROVIDE FOR THE SMOOTH FLOW OF A CONTINUOUS LIQUID FILM. THE CONFRONTING HEATING SURFACES OF SUCCESSIVE HEATING ELEMENTS ARE SPACED TO PROVIDE CHANNELS WHICH ARE OPEN AT BOTH VERTICAL EDGES OF THE HEATING ELEMENTS. A MEANS IS PROVIDED TO DISTRIBUTE FEED AT THE UPPER EDGES OF THE HEATING ELEMENTS AND A MEANS TO INTRODUCE AND REMOVE A HEATING FLUID FROM WITHIN THE HEATING ELEMENTS. A CASING IS PROVIDED WITH A VAPOR RECEIVING SPACE AT EACH VERTICAL EDGE OF THE HEATING ELEMENTS SO AS TO READILY PERMIT THE REMOVAL OF VAPORS.

*COMPONENT DESIGNS + *EVAPORATOR SYSTEM DESIGN + *FALLING FILM EVAPORATION + DISTILLATION PROCESSES + EVAPORATOR-CONDENSER SYSTEM DESIGNS + EVAPORATORS + FILM CONDENSATION + FILM EVAPORATION + PATENTS + VAPOR COMPRESSION EVAPORATION + VERTICAL TUBE EVAPORATORS

30-01015 AKIMOTO S

SALT WATER CONCENTRATION WITH ALUMINA-SILICA ADDITIVE AND SEPARATION OF SODIUM SULFATE-CALCIUM SULFATE DOUBLE SALT

KURITA INDUSTRIAL CO., OSAKA, JAPAN

U.S.PAT. 3,358,740 (11-4-63/12-19-67), 8 REF

A METHOD FOR CONCENTRATING SEAWATER, THE IMPROVEMENT CONSISTING OF ADDING TO THE SEAWATER AT LEAST ONE ADDITIVE FROM THE GROUP CONSISTING OF SILICA, SILICIC ACID, ALUMINA, AN ALUMINOSILICATE, ACID CLAY, KAOLIN, AND BENTONITE SO AS TO REDUCE SCALE FORMATION. ALSO A SCALE REDUCING METHOD CONSISTING OF ADDING ONE OF THE ABOVE ADDITIVES PLUS CALCIUM CHLORIDE OR CALCIUM SULFATE WHEREBY SCALE FORMATION IS REDUCED AND SULFATE IONS ORIGINALLY PRESENT IN THE SEAWATER ARE CONVERTED TO A SODIUM SULFATE-CALCIUM SULFATE DOUBLE SALT.

*FEEDWATER TREATMENT + *SCALE PREVENTION + CHEMICAL ADDITIVES + CHEMICAL BY-PRODUCTS + DISTILLATION PROCESSES + PATENTS + SCALE REMOVAL + SCALING

30-01016 HAMMER JB + SCHMERS EV

FALLING FILM DISTILLATION UNIT APPARATUS

WESTINGHOUSE ELECTRIC CORP., EAST PITTSBURGH, PA.

U.S.PAT. 3,211,633 (5-28-62/10-12-65), 9 FIG, 2 REF

THE DESIGN OF AN IMPROVED ARRANGEMENT FOR DISTRIBUTING LIQUID FEED ONTO THE EVAPORATOR PLATES OF HEAT EXCHANGE APPARATUS. BRIEFLY, THERE IS PROVIDED LIQUID EVAPORATING APPARATUS WITH A NUMBER OF EVAPORATOR PLATES IN HORIZONTALLY SPACED SIDE-BY-SIDE RELATION WITH EACH OTHER AND INCLINED WITH THE HORIZONTAL, SPRAY NOZZLE STRUCTURE FOR SPRAYING PRESSURIZED FEED ONTO THE PLATE MEMBERS, AND MEANS FOR CYCLICALLY VARYING THE SPRAY PATTERN SO THAT FEED IS SPRAYED ONTO EACH OF THE PLATE MEMBERS IN A PREDETERMINED SEQUENCE.

*EVAPORATOR SYSTEM DESIGN + *FALLING FILM EVAPORATION + *SPRAY NOZZLES + COMPONENT DESIGNS + DISTILLATION PROCESSES + EVAPORATORS + FILM EVAPORATION + HEAT EXCHANGERS + PATENTS

30-01017 BLANCO RE + CLARK WE + YEE WC

CHEMICAL CYCLE FOR EVAPORATIVE WATER DESALINATION PLANT

U.S. DEPARTMENT OF THE INTERIOR, WASHINGTON

U.S.PAT. 3,463,814 (3-24-67/8-26-69), 4 FIG, 9 REF

A PROCESS FOR PREVENTING SCALE AND OBTAINING BY-PRODUCTS FROM THE CONVERSION OF SALINE WATERS WHICH INCLUDES THE CONTACTING OF SALINE WATER WITH AN ALKALI CONTAINING SODIUM CARBONATE TO PRECIPITATE OUT CALCIUM CARBONATE, THE RECOVERY OF PURIFIED WATER BY THE EVAPORATION AND CONDENSATION OF A PORTION OF THE SALINE WATER, TREATING THE CALCIUM CARBONATE TO FORM CARBON DIOXIDE, ELECTROLYZING A PORTION OF THE CONCENTRATED BRINE TO PRODUCE HYDROGEN, CHLORINE AND CAUSTIC, AND TREATING THE CAUSTIC WITH A PORTION OF THE CARBON DIOXIDE TO PRODUCE RECYCLE SODIUM CARBONATE AND WHICH MAY FURTHER INCLUDE THE PRECIPITATION OF MAGNESIUM OF THE SALINE WATER WITH A STRONG BASE, AND THE PRODUCTION OF UREA USING HYDROGEN FROM ELECTROLYSIS AND CARBON DIOXIDE.

*BY-PRODUCT MANUFACTURING PROCESSES + *FEEDWATER TREATMENT + *SCALE PREVENTION + CHEMICAL ADDITIVES + CHEMICAL BY-PRODUCTS + CHEMICAL PRODUCTION + DISTILLATION PROCESSES + FLOWSHEETS + PATENTS + SCALING

30-01018 COWLEY JJ

SERIES EVAPORATOR-TRAY COMPRESSOR TYPE VACUUM STILL

DESAL LIMITED, TORONTO, CANADA

U.S.PAT. 3,305,454 (2-19-65/2-21-67), 13 FIG, 11 REF

A PROCESS AND APPARATUS FOR THE CONTINUOUS REGENERATIVE DISTILLATION OF SEAWATER. A CLOSED AND SEALED VESSEL DIVIDED BY A PHASE SEPARATION BARRIER INTO VAPORIZATION AND CONDENSATION CHAMBERS IS EVACUATED TO A HIGH VACUUM BY CONTINUOUS EVACUATION FROM THE CONDENSATION CHAMBER. SEAWATER FEED IS ADMITTED INTO THE VAPORIZATION CHAMBER AND IS PASSED ALONG A LARGE NUMBER OF SEPARATE FLOW PATHS DEFINED BY A HEAT EXCHANGE SURFACE BY GRAVITY FLOW BY TILTING OF THE SURFACE SLIGHTLY BELOW THE HORIZONTAL. THIS INDUCES CONTINUOUS AGITATING AND TUMBLING ACTION OF THE LIQUID AND MAINTAINS THE HEAT EXCHANGE SURFACE FREE FROM A LAMINAR FILM. THE VAPOR FORMED IS TRANSFERRED WITHIN THE VESSEL ALONG A CONTINUALLY WIDENING PATH AND AROUND THE PHASE SEPARATION BARRIER INTO THE CONDENSATION CHAMBER BY MEANS OF A BLOWER WHICH INCREASES THE PRESSURE AND TEMPERATURE OF THE VAPOR. IN THE CONDENSATION CHAMBER THE VAPOR IS PASSED ALONG A CONTINUALLY NARROWING PATH IN CONTACT WITH A HEAT EXCHANGE SURFACE WHERE IT CONDENSES INTO

ACCESSION NUMBER 30-01013 TO 30-01018

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01018 *CONTINUED*

DROPLETS. WATER DROPLETS FORMING AT THE CONDENSATION SURFACE DROP FREELY UNDER THE INFLUENCE OF GRAVITY WITHOUT MERGING INTO A LIQUID FLOW. SEPARATION OF THE DROPLETS IS ACCELERATED BY APPLYING CYCLICAL SHOCKS TO THE WATER VAPOR IN THE CONDENSATION CHAMBER AND BY SURFACE TREATMENT OF THE SURFACE SUCH AS WITH A SILICONE COATING.

*COMPONENT DESIGNS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + *HEAT TRANSFER SURFACES + CONDENSATION PROMOTERS + DISTILLATION PROCESSES + DROPWISE CONDENSATION + FILM EVAPORATION + PATENTS + VAPOR COMPRESSION EVAPORATION + VAPOR REHEAT PROCESSES

30-01019 WIRTH LF, JR.

PROCESS FOR SCALE PREVENTION IN SALINE WATER EVAPORATOR

NALCO CHEMICAL CO., CHICAGO

U.S.PAT. 3,203,873 (3-15-62/8-31-65), 3 FIG, 7 REF

A CONTINUOUS PROCESS FOR PREVENTING THE DEPOSIT OF SCALE ON THE SURFACES OF THE HEAT-EXCHANGERS OF A MULTIPLE EFFECT SEAWATER DISTILLATION UNIT. A CATION-EXCHANGE RESIN IS ADDED TO THE SEAWATER FEED AND REMOVES CALCIUM AND MAGNESIUM IONS FROM THE WATER. THE RESIN IS ALLOWED TO FLOW WITH THE BRINE THROUGH THE VARIOUS EFFECTS OF THE SYSTEM. IN THE LAST EFFECT THE BRINE CONCENTRATION HAS INCREASED SO THAT THE SODIUM CONCENTRATION IS SUFFICIENT IN SOLUTION TO REGENERATE THE RESIN BUT THE RESULTANT RELEASE OF CALCIUM AND MAGNESIUM IS NOT HARMFUL SINCE THE TEMPERATURE IS LOWER AND SCALE DOES NOT FORM. THE REGENERATED RESIN IS RETURNED TO THE FIRST EFFECT EITHER WITH THE BRINE OR IT CAN BE REMOVED WITH A HYDROCLONE FOR RECYCLE IF THE BRINE IS NOT RECYCLED.

*FEEDWATER TREATMENT + *ION EXCHANGING + *SCALE PREVENTION + DISTILLATION PROCESSES + MULTIPLE EFFECT DISTILLATION + PATENTS + REMOVAL FROM FEEDWATER, CALCIUM + REMOVAL FROM FEEDWATER, MAGNESIUM + SCALING

30-01020 DUNSETH MG + SALUTSKY ML

METHOD OF RECOVERING POTASSIUM VALUES FROM BRINES

W.R. GRACE AND CO., NEW YORK

U.S.PAT. 3,195,978 (11-14-61/7-20-65), 5 REF

RECOVERY OF POTASSIUM SALT FROM SEAWATER IS ACCOMPLISHED BY ADDITION OF CHEMICALS AND PH ADJUSTMENT. SUFFICIENT AMOUNTS OF PHOSPHATE IONS ARE ADDED TO PROVIDE A PHOSPHATE TO MAGNESIUM + CALCIUM MOLE RATIO OF AT LEAST 0.8. THE PH OF THE PHOSPHATE TREATED SEAWATER IS RAISED TO BETWEEN 7.5 AND 9.5 BY ADDING AMMONIA-FREE SODIUM HYDROXIDE. THE POTASSIUM CONTAINING SOLIDS PRECIPITATE FROM THE SEAWATER AND SEPARATED AND ARE THEN REACTED WITH AN AQUEOUS SOLUTION OF AN AMMONIUM SALT TO FORM A POTASSIUM SALT SOLUTION.

*BY-PRODUCT MANUFACTURING PROCESSES + *FEEDWATER TREATMENT + *SCALE PREVENTION + CHEMICAL ADDITIVES + CHEMICAL BY-PRODUCTS + CHEMICAL PRODUCTION + DISTILLATION PROCESSES + FERTILIZER + PATENTS + PH ADJUSTMENT + REMOVAL FROM FEEDWATER, CALCIUM + REMOVAL FROM FEEDWATER, MAGNESIUM + SCALING

30-01021 CANE D

INTEGRAL MAKE-UP DEAERATOR FOR FLASH EVAPORATOR

WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.

U.S.PAT. 3,418,214 (2-16-67/12-24-68)

A COMPACT DEAERATOR APPARATUS FOR REMOVING AIR, CARBON DIOXIDE AND OTHER NON-CONDENSIBLE GASES FROM A MAKE-UP LIQUID DIRECTED TO A FLASH EVAPORATOR FOR FLASH EVAPORATION. THE DEAERATOR APPARATUS IS FORMED INTEGRALLY WITH AND DISPOSED WITHIN THE FLASH EVAPORATOR AND COMPRISES GENERALLY A HEATING SECTION AND A GAS STRIPPING OR DEAERATING SECTION. VAPOR IS GENERATED IN THE FLASH CHAMBER, THE GREATER PORTION OF WHICH IS DIRECTED INTO A CONDENSING SPACE WHERE IT IS CONDENSED TO FORM A SUBSTANTIALLY PURE PRODUCT LIQUID. A LESSER PORTION OF THE GENERATED VAPOR IS DIRECTED THROUGH THE STRIPPING SECTION TO STRIP THE INCOMING, PREHEATED MAKE-UP LIQUID OF NONCONDENSIBLE GASES. THE STRIPPED GASES AND STEAM ARE THEN ROUTED TO THE HEATING SECTION TO WHICH THE MAKE-UP LIQUID IS FIRST DIRECTED. THE STEAM PREHEATS THE MAKE-UP LIQUID TO SATURATION TEMPERATURE WHICH CAUSES THE RELEASE OF A MAJOR PORTION OF THE NONCONDENSIBLE GASES CONTAINED IN THE LIQUID BEFORE THE LIQUID IS DIRECTED INTO THE STRIPPING SECTION FOR THE STRIPPING ACTION. FROM THE STRIPPING SECTION, THE SUBSTANTIALLY DEAERATED MAKE-UP LIQUID JOINS THE BODY OF RECIRCULATING LIQUID FOR FLASH EVAPORATION. THE AIR AND OTHER NONCONDENSIBLE GASES ARE VENTED FROM THE HEATING SECTION.

*DEAERATION + *DEAERATORS + *FEEDWATER TREATMENT + CARBON DIOXIDE REMOVAL + COMPONENT DESIGNS + DIRECT CONTACT HEAT EXCHANGE + DISTILLATION PROCESSES + FLASH EVAPORATION + MULTISTAGE FLASH DISTILLATION + NONCONDENSABLE REMOVAL + PATENTS

30-01022 DAVIAU JG

HYDRAULIC SALT WATER CONVERSION UNIT

U.S.PAT. 3,206,380 (3-10-60/9-14-65)

A DESALINATION SYSTEM CONSISTING OF A VESSEL FOR FRESH WATER, AN INLET PIPE FOR RELATIVELY COOL SALT WATER EXTENDING INTO THE VESSEL, A RECEPTACLE WITHIN THE VESSEL, AND A PERFORATED CONDUIT IN THE RECEPTACLE CLOSED AT ONE END AND COMMUNICATING AT ITS OTHER END WITH THE INLET PIPE. THERE IS A HEAT EXCHANGER TUBE WITHIN THE PERFORATED CONDUIT WITH OPEN ENDS EXTENDING OUTWARDLY FROM THE RECEPTACLE AND COMMUNICATING WITH THE INTERIOR OF THE VESSEL. THE RECEPTACLE HAS AN UPPER WALL WITH MEANS FOR ASPIRATING INCORPORATED. THERE IS A CIRCULATING PUMP IN THE VESSEL ARRANGED TO FORCE FRESH WATER FROM THE VESSEL THROUGH THE ASPIRATOR TO REDUCE THE PRESSURE IN THE RECEPTACLE AND TO INDUCE FLOW OF SALT WATER THROUGH THE INLET PIPE FOR DISCHARGE THROUGH THE PERFORATIONS AND EVAPORATION IN THE RECEPTACLE. THE HIGH VELOCITY FRESH WATER FURTHER CONDENSES THE ASPIRATED VAPOR AND FORCES WATER FROM THE VESSEL THROUGH THE HEAT EXCHANGE TUBE TO INCREASE THE TEMPERATURE OF THE SALT WATER IN THE PERFORATED CONDUIT TO FURTHER INCREASE EVAPORATION.

*COMPONENT DESIGNS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + EVAPORATORS + PATENTS

ACCESSION NUMBER 30-01018 TO 30-01022

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01023 POTTHARST JE, JR.
COMBINED EVAPORATOR AND BOILER
U.S.PAT. 2,456,732 (2-19-46/12-21-48)

THE DESIGN OF AN EVAPORATOR STRUCTURE CONSISTING OF AN OUTER ENCLOSURE, A BANK OF TUBES IN WHICH THE SOLUTION TO BE EVAPORATED IS MAINTAINED, A HEATING CHAMBER THROUGH WHICH THE TUBES EXTEND, A SECOND BANK OF TUBES EXTENDING THROUGH THE HEATING CHAMBER AND THROUGH WHICH HOT GASES TRAVEL, AND A BAFFLE EXTENDING UPWARDLY FROM THE FLOOR OF THE HEATING CHAMBER AND SEPARATING THE LOWER PORTIONS OF THE TWO BANKS OF TUBES. MEANS IS PROVIDED FOR MAINTAINING A SUPPLY OF LIQUID IN THE PORTION OF THE CHAMBER WALLED OFF BY THE BAFFLE AND SURROUNDING THE SECOND BANK OF TUBES. THE LIQUID IS BOILED BY THE HOT GASES AND THE STEAM FLOWS OVER THE BAFFLE AND EVOLVES VAPORS FROM THE SOLUTION IN THE FIRST BANK OF TUBES. THERE IS ALSO MEANS FOR WITHDRAWING FROM THE EVAPORATOR THE VAPORS AND FOR WITHDRAWING FROM THE CHAMBER THE CONDENSATE FROM THE STEAM.

*COMPONENT DESIGNS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + EVAPORATORS + PATENTS + VERTICAL TUBE EVAPORATORS

30-01024 OTHMER OF
METHOD FOR COOLING VOLATILE LIQUIDS
U.S.PAT. 3,306,346 (12-3-62)

THE METHOD OF COOLING A FIRST LIQUID STREAM CONTAINING A VOLATILE LIQUID BY (1) PASSING IT THROUGH A SERIES OF THREE OR MORE STAGES, EACH OF A SUCCESSIVELY LOWER TEMPERATURE WHICH RESULTS IN THE FLASH EVAPORATION OF THE VOLATILE LIQUID AND COOLING OF THE STEAM, (2) PASSING A SECOND LIQUID STREAM THROUGH THE STAGES IN COUNTER-CURRENT FLOW AND IN THE FORM OF DROPLETS OR A FILM. THE SECOND LIQUID STREAM CONDENSES SUBSTANTIALLY ALL OF THE VAPORS FORMED BY THE FLASH EVAPORATION IN EACH STAGE AND HEATS THE SECOND LIQUID STREAM. THE SECOND LIQUID STREAM IS PUMPED BETWEEN STAGES.

*CONDENSERS + *DIRECT CONTACT HEAT EXCHANGE + DISTILLATION PROCESSES + EVAPORATOR-CONDENSER SYSTEM DESIGNS + HEAT EXCHANGERS + PATENTS

30-01025 WILLIAMSON WR
MULTISTAGE EVAPORATOR WITH EVAGINATED VENTURI INLET FOR EACH STAGE
AMERICAN MACHINE AND FOUNDRY COMPANY, N. J.
U.S.PAT. 3,418,213 (3-17-65/12-24-68)

A STAGE FOR A MULTISTAGE FLASH DISTILLATION UNIT HAVING AN ENTRANCE SURROUNDED BY A VENTURI FLOW CONTROL DEVICE COMPRISING AN UPWARD WALL AND A HORIZONTALLY EXTENDING WALL DEFINING BETWEEN THEM A NARROW UNOBSTRUCTED OPENING ACROSS THE STAGE CAUSING THE INCOMING FLUID TO FLOW IN A HORIZONTAL SHEET ACROSS THE BOTTOM WALL.

*BAFFLES + *COMPONENT DESIGNS + *FLASH CHAMBERS + *MULTISTAGE FLASH DISTILLATION + BRINE FLOW + DISTILLATION PROCESSES + FLOW DISTRIBUTION + PATENTS

30-01026 POTTHARST JE, JR.
PLATE-TYPE HEAT EXCHANGER
U.S.PAT. 3,404,733 (6-21-67/10-8-68)

A HEAT EXCHANGER INCLUDING A PLURALITY OF IDENTICAL, GENERALLY RECTANGULAR, FLAT FLOW PLATES. EACH PLATE HAS A LIP EXTENDING AROUND ITS PERIMETER AND A GASKET SECURED TO THE LIPPED SIDE OF EACH PLATE. TO SECURE THE GASKETS, THE PLATE MAY HAVE A PLURALITY OF SPACED INTEGRAL GASKET KEYS AND THE GASKETS HAVE MATING APERTURES. THE GASKETS HAVE FLW APERTURES WHICH MATE WITH THE FLOW APERTURES IN THE PLATE AND BARRIERS SURROUNDING EACH FLOW APERTURE. SLITS ARE PROVIDED IN A MATING PAIR OF BARRIERS TO PERMIT FLOW FROM ONE END TO THE OTHER. THE GASKET IS PROVIDED WITH FINGERS WHICH FORM A TORTUOUS PATH FROM ONE END OF THE PLATE TO THE OTHER END.

*COMPONENT DESIGNS + *HEAT EXCHANGERS + DISTILLATION PROCESSES + FEEDWATER HEATING + HEAT TRANSFER + PATENTS

30-01027 BROWN KD
DISTILLATION APPARATUS WITH ULTRASONIC FREQUENCY AGITATION
U.S.PAT. 3,317,405 (10-21-65/5-2-67)

A LIQUID PURIFICATION SYSTEM CONSISTING OF AN EVAPORATING CHAMBER, A CLOSED TANK FOR CONTAINING A BODY OF PURIFIED LIQUID, MEANS INCLUDING A PUMP FOR PRODUCING A LOW PRESSURE IN THE EVAPORATING CHAMBER AND FOR DELIVERING EVAPORATED LIQUID TO THE TANK, MEANS FOR SUPPLYING FEEDWATER TO THE CHAMBER, MEANS FOR HEATING THE FEEDWATER, AND AN ULTRASONIC ENERGY TRANSDUCER MOUNTED IN THE CHAMBER ABOVE THE LIQUID LEVEL, AND MEANS FOR DIRECTING LIQUID SUPPLIED TO THE CHAMBER ONTO THE SURFACE OF THE TRANSDUCER. THE TRANSDUCER IS ENERGIZED AND AT LEAST A PORTION OF THE LIQUID FLOWING ONTO THE TRANSDUCER IS EVAPORATED BY ULTRASONIC ENERGY THUS INCREASING THE RATE OF EVAPORATION IN THE CHAMBER. THE PUMP FOR PRODUCING LOW PRESSURE AND FOR DELIVERING EVAPORATED LIQUID IS A COMBINED LIQUID-VAPOR PUMP ARRANGED IN THE TANK WITH ONE INLET FOR WITHDRAWING VAPOR FROM THE CHAMBER AND A SECOND INLET FOR CIRCULATING LIQUID IN THE TANK. HEAT PRODUCED BY THE OPERATION OF THE PUMP IS USED FOR HEATING THE LIQUID.

*AGITATION + *EVAPORATOR SYSTEM DESIGN + *SOUND (ACOUSTICAL) + DISTILLATION PROCESSES + EVAPORATORS + PATENTS

30-01028 GEIRINGER PL
MULTI-EFFECT EVAPORATION SYSTEM
AMERICAN HYDROTHERM CORP., N. Y.
U.S.PAT. 3,403,719 (2-10-65/10-1-68)

A MULTI-EFFECT EVAPORATION SYSTEM WHEREIN EACH EFFECT IS ENCLOSED IN A SEPARATE CASING HAVING A PLURALITY OF FLAT SURFACES A PORTION OF WHICH IS INCLINED, AND THE CASING CONTAINS A LOWER INTERIOR PORTION FOR INTRODUCING LIQUID AND AN UPPER INTERIOR PORTION FOR COLLECTING VAPOR. THE LIQUID INLET AND OUTLETS ARE COMPRISED OF A PLURALITY OF ORIFICES IN THE CASING, WITH THE CASINGS OF ADJACENT EFFECTS BEING IN ABUTTING RELATIONSHIP WITH EACH OTHER IN A MANNER SUCH THAT THE ORIFICES ARE ALIGNED SO THAT LIQUID CAN FLOW FROM ONE EFFECT TO ANOTHER. THE TUBES ARE ENCLOSED IN A SEPARATE COMPARTMENT AND ARE PARALLEL TO THE INCLINED PORTION OF THE CASING. THE VAPOR

ACCESSION NUMBER 30-01023 TO 30-01028

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01028 *CONTINUED*

GENERATED IN THE TUBES IS COLLECTED IN THE SECOND INTERIOR PORTION WHICH IS PROVIDED WITH AN OUTLET FOR EFFECTING PASSAGE THEREOF TO THE HEATING COMPARTMENT OF THE NEXT ADJACENT EFFECT.

*MULTIPLE EFFECT DISTILLATION + *SYSTEM DESCRIPTIONS + DISTILLATION PROCESSES + EVAPORATOR-CONDENSER SYSTEM DESIGNS + PATENTS

30-01029 SPRAY CL

PRODUCTION OF FRESH WATER FROM SALT WATER

U.S.PAT. 3,402,106 (3-31-66/9-17-68)

HEAT EXCHANGE APPARATUS FOR EVAPORATING AND CONCENTRATING SALINE WATER TO PRODUCE WATER INSOLUBLE SALTS IN THE FORM OF SCALE PARTICLES WHICH ARE REMOVED BY STRAINING. THE SALINITY OF THE CONCENTRATE IS SENSED AND THE CONCENTRATE IS BLOWN DOWN WHEN ITS SALINITY EXCEEDS A PREDETERMINED VALUE. A TIMER LIMITS BLOWDOWN TO PERIODIC INTERVALS.

*SYSTEM DESCRIPTIONS + BRINE SYSTEM DESIGNS + CONTROL SYSTEMS + DISTILLATION PROCESSES + FLOWSHEETS + MULTIPLE EFFECT DISTILLATION + PATENTS + SCALE PREVENTION

30-01030 LINDSAY WT, JR.

WATER CONVERSION PROCESS AND APPARATUS

WESTINGHOUSE ELECTRIC CORP., PITTSBURGH

U.S.PAT. 3,401,094 (4-21-66/9-10-68)

A PROCEDURE FOR REMOVING SCALE-FORMING SALT (CALCIUM SULFATE) IN AN EVAPORATOR SYSTEM FOR RECOVERING FRESH WATER FROM MINERAL-CONTAINING WATER, WHEREBY SEED PARTICLES OF THE MINERAL TO BE REMOVED ARE ADDED TO THE MINERAL-CONTAINING WATER AFTER WHICH THE WATER IS HEATED TO A PREDETERMINED TEMPERATURE LEVEL AND HELD IN A PASSIVE CONDITION FOR A SUFFICIENT TIME TO ENABLE THE SCALE-FORMING SALT IN SOLUTION IN THE WATER TO COMBINE WITH THE SEED PARTICLES AND PRECIPITATE OUT OF THE SOLUTION.

*SCALE PREVENTION + *SEEDING PROCESSES + DISTILLATION PROCESSES + FEEDWATER TREATMENT + FLASH EVAPORATION + MULTISTAGE FLASH DISTILLATION + PATENTS + REMOVAL FROM FEEDWATER, CALCIUM + SCALING

30-01031 MURPHY RG

SALT WATER CONVERSION SYSTEM

U.S.PAT. 3,318,784 (11-1-53/5-9-67)

A SALT WATER CONVERSION SYSTEM CONSISTING OF A FEEDWATER RESERVOIR OPEN TO ATMOSPHERIC PRESSURE AND AN EVAPORATOR ABOVE THE RESERVOIR. THE EVAPORATOR HAS A NUMBER OF COMPARTMENTS CONNECTED IN SERIES AT THE BOTTOM, MEANS FOR REMOVING WATER VAPOR FROM THE COMPARTMENTS, AND A PIPE FROM THE RESERVOIR TO THE BOTTOM OF THE FIRST COMPARTMENT. THE EVAPORATOR IS HIGH ENOUGH ABOVE THE RESERVOIR SO THAT THE WATER-LEG REDUCES THE PRESSURE IN THE FIRST COMPARTMENT AND CAUSES BOILING IN THE COMPARTMENT. THE WATER LEVEL IN THE SUCCESSIVE COMPARTMENTS IS ELEVATED WITH RESPECT TO EACH PRECEDING COMPARTMENT SO THAT BOILING OCCURS. VAPOR IS WITHDRAWN FROM EACH COMPARTMENT WITH A WATER EJECTOR.

*COMPONENT DESIGNS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + EVAPORATORS + PATENTS + VACUUM SYSTEMS + WATER JET EJECTORS

30-01032 SOOD RK

METHOD OF DEAERATING SEA WATER

ATOMIC ENERGY COMMISSION, WASHINGTON

U.S.PAT. 3,458,972 (9-11-68/8-5-69)

IN THIS METHOD OF REMOVING DISSOLVED GASES FROM SEA WATER, TWO ADJACENT DEAERATION CHAMBERS ARE PROVIDED BOTH OF WHICH ARE MAINTAINED AT SUBATMOSPHERIC PRESSURES. SEAWATER HEATED IN THE FINAL CONDENSER OF AN EVAPORATOR SYSTEM IS INTRODUCED INTO A FIRST CHAMBER WHERE A PORTION OF IT FLASHES TO VAPOR, PROVIDING AN ATMOSPHERE WHICH FACILITATES THE REMOVAL OF DISSOLVED GASES. COLD SEAWATER IS INTRODUCED INTO THE SECOND CHAMBER, WHEREIN IT IS CONTACTED WITH STEAM FROM THE FIRST CHAMBER. DEAERATED WATERS FROM BOTH CHAMBERS ARE COLLECTED IN A COMMON SUMP AND REMOVED.

*DEAERATION + *DEAERATORS + *FEEDWATER TREATMENT + CARBON DIOXIDE REMOVAL + COMPONENT DESIGNS + DIRECT CONTACT HEAT EXCHANGE + DISTILLATION PROCESSES + MULTIPLE EFFECT DISTILLATION + MULTISTAGE FLASH DISTILLATION + NONCONDENSABLE REMOVAL + PATENTS

30-01033 POTTHARST JE, JR.

EVAPORATOR

U.S.PAT. 2,509,108 (6-11-45/5-23-50)

A COMPACT EVAPORATOR CONSISTING OF A PAIR OF SPACED VERTICAL CYLINDRICAL SHELLS CLOSED AT THEIR ENDS AND EACH HAVING A NUMBER OF TUBES PASSING THROUGH THEM. A COMMON VAPOR CHAMBER IS OPEN TO THE TUBES OF EACH SHELL AT THE TOP AND THERE IS A COMMON SOLUTION CHAMBER OPEN TO THE TUBES OF EACH SHELL AT THE BOTTOM. THERE ARE FRONT AND REAR WALLS CONNECTING THE SHELLS AND A COMMON DOWNTAKE OPEN TO BOTH OF THE CHAMBERS. THE WALLS CONNECT THE SHELLS AT THEIR GREAT DIAMETERS AT THE TOP NEAR THE VAPOR CHAMBER AND APPROACH EACH OTHER NEAR THE BOTTOM FORMING A THROAT WHICH OPENS TO THE SOLUTION CHAMBER. THERE IS AN UPWARDLY OPEN BLOWDOWN PIPE IN THE DOWNTAKE ABOVE THE THROAT, A DOWNWARDLY OPEN FEED PIPE IN THE THROAT BELOW THE BLOWDOWN PIPE, AND A BAFFLE CONNECTING THE SHELLS BETWEEN THE FRONT AND REAR WALLS. A VAPOR WITHDRAWAL PIPE COMMUNICATES WITH THE UPPER END OF THE DOWNTAKE AND ON ONE SIDE OF THE BAFFLE. THERE IS A COMMON VAPOR SUPPLY DUCT CONNECTED TO THE INTERIOR OF BOTH SHELLS AND A COMMON PIPE FOR WITHDRAWING CONDENSATE FROM THE INTERIOR OF THE SHELLS.

*COMPONENT DESIGNS + *EVAPORATORS + DISTILLATION PROCESSES + EVAPORATOR-CONDENSER SYSTEM DESIGNS + PATENTS

30-01034 POTTHARST JE, JR.

HEAT EXCHANGER

U.S.PAT. 2,713,996 (10-23-52/7-26-55)

A HEAT EXCHANGER CONSISTING OF A NUMBER OF CONCENTRICALLY MOUNTED INNER AND OUTER

ACCESSION NUMBER 30-01028 TO 30-01034

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01034 *CONTINUED*

TUBES, CONNECTING MEANS BETWEEN THE ENDS OF PAIRS OF OUTER TUBES, CONNECTING MEANS BETWEEN THE ENDS OF PAIRS OF INNER TUBES, THREADED MEANS ADJUSTABLE TO PRODUCE RELATIVE AXIAL MOVEMENT BETWEEN THE INNER AND OUTER TUBES TO SECURE THE OUTER TUBES, AND THE OUTER TUBE CONNECTING MEANS ASSOCIATED THEREWITH IN FLUID TIGHT RELATIONSHIP AND TO EXERT TENSION ON INNER TUBES.

*FABRICATION METHODS + *HEAT EXCHANGERS + CONDENSERS + DISTILLATION PROCESSES + EVAPORATORS + PATENTS + TUBING (METAL)

30-01035 POTTHARST JE, JR.
FORCED CIRCULATION EVAPORATOR

U.S.PAT. 3,192,130 (2-8-60/6-29-65)

A DISTILLATION APPARATUS CONSISTING OF A HOUSING WITH A VAPORIZATION CHAMBER WHICH HAS AN UPPER VAPOR SECTION AND A LOWER LIQUID SECTION. IN THE CENTER OF THE LIQUID SECTION THERE IS LOCATED AN IMPELLER WHICH CAUSES THE LIQUID TO FLOW DOWN IN THE CENTER AND UPWARD AROUND THE OUTER WALLS. A VERTICAL TUBE HEAT EXCHANGER IS LOCATED AROUND THE OUTER WALLS (THE TUBE BUNDLE IS IN THE FORM OF A DOUGHNUT) SO THAT THE LIQUID FLOWS UP THROUGH THE TUBES. HEATED BRINE IS SUPPLIED TO THE LIQUID SECTION. IN THE UPPER SECTION OF THE HOUSING, VAPOR IS SEPARATED FROM LIQUID DROPLETS AND THE VAPOR PASSES ON THE OUTSIDE OF THE TUBES OF THE DOUGHNUT SHAPED TUBE BUNDLE. HERE IT CONDENSES TO FORM PRODUCT WATER AND AT THE SAME TIME HEATS ADDITIONAL BRINE WITHIN THE TUBES.

*COMPONENT DESIGNS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + *VERTICAL TUBE EVAPORATORS + DISTILLATION PROCESSES + EVAPORATORS + PATENTS + TURBULENT FLOW

30-01036 RCE RC + LICHTENSTEIN J
MULTI-CELL FLASH DISTILLATION SYSTEM
SALINE WATER CONVERSION CORP., N. Y.
U.S.PAT. 3,330,739 (6-5-64/7-11-67)

A FRESH WATER RECOVERY DEVICE CONSISTING OF A NUMBER OF VERTICAL EVAPORATOR PLATES CLOSELY POSITIONED, FACE-TO-FACE, WITH A CONDENSER MEANS POSITIONED BETWEEN THE PLATES. FEEDWATER IS DISTRIBUTED DOWNWARDLY OVER THE SURFACE AREA OF THE PLATES, THE EXTERIOR SURFACES OF THE EVAPORATOR PLATES AND CONDENSER MEANS BEING EXPOSED WITHIN VERTICALLY ALIGNED PRESSURE ISOLATED EVAPORATOR CELLS. THIS ISOLATION PERMITS CONTINUOUS AND UNINTERRUPTED FLOW OF BRINE DOWNWARDLY FROM ONE CELL TO THE NEXT. THERE IS MEANS FOR COLLECTING THE PURIFIED WATER WHICH FORMS ON THE EXTERNAL SURFACES OF THE CONDENSER IN EACH CELL.

*COMPONENT DESIGNS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + FLASH CHAMBERS + FLASH EVAPORATION + MULTISTAGE FLASH DISTILLATION + PATENTS

30-01037 HAMMEND RP
MULTISTAGE FLASH EVAPORATOR
ATOMIC ENERGY COMMISSION, WASHINGTON

U.S.PAT. 3,342,697 (7-28-64/9-19-67), 4 FIG, 7 REF

A MULTISTAGE-MULTILEVEL EVAPORATOR INCLUDING A CONCRETE SHELL, A NUMBER OF TRAYS STACKED VERTICALLY AND IN ROWS IN A CHAMBER, AND MEANS FOR DISTRIBUTING HEATED BRINE TO EACH OF THE TRAYS TO FLOW FROM ONE END TO THE OTHER OF THE CHAMBER. CONDENSER TUBES ARE IN BANKS ARE LOCATED ON OPPOSITE SIDES FROM THE TRAYS AND EXTEND FROM ABOVE THE TOPMOST TRAY ROW TO ABOVE THE BOTTOMMOST TRAY ROW. COOLING SEAWATER IS PUMPED THROUGH THE TUBES TO CONDENSE VAPORS. THERE ARE VERTICAL BAFFLES TO DIVIDE THE CHAMBER INTO A SERIES OF COMPARTMENTS OF GRADUALLY DECREASING TEMPERATURE AND PRESSURE. THE BAFFLES EXTEND BELOW THE NORMAL LIQUID LEVEL IN THE TRAYS. THERE ARE ALSO BAFFLES FROM THE BOTTOM OF THE TRAYS SO AS TO FORM WEIRS. THERE IS MEANS FOR COLLECTING BRINE FROM THE DOWNSTREAM ENDS OF THE TRAYS FOR PARTIAL RECYCLING AND MEANS TO COLLECT CONDENSED VAPOR.

*MULTILEVEL PLANTS + *MULTISTAGE FLASH DISTILLATION + *SYSTEM DESCRIPTIONS + COMPONENT DESIGNS + COMPONENT DESIGNS + CONCRETE CONSTRUCTION + DISTILLATION PROCESSES + EVAPORATOR-CONDENSER SYSTEM DESIGNS + EVAPORATORS + FLASH CHAMBERS + FLASH EVAPORATION + HORIZONTAL TUBE CONDENSERS + PATENTS

30-01038 KUN LC + CZIKK AM
SURFACE FOR BOILING LIQUIDS
UNION CARBIDE CORP., N. Y.
U.S.PAT. 3,454,081 (5-14-68/7-8-69)

A BOILING SURFACE LAYER IS FORMED ON A THERMALLY CONDUCTIVE WALL COMPRISING A PLURALITY OF RIDGES SEPARATED BY GROOVES PROVIDED AT MICROSCOPIC DENSITY, WITH OUTER SECTIONS OF THE RIDGES PARTLY DEFORMED INTO ADJACENT GROOVES TO PROVIDE SUB-SURFACE CAVITIES WITH RESTRICTED OPENINGS TO THE OUTER SURFACE AND SUB-SURFACE, OPENINGS BETWEEN SOME OF THE CAVITIES.

*EXTENDED HEAT TRANSFER SURFACES + *HEAT TRANSFER IMPROVEMENTS + DISTILLATION PROCESSES + FILM BOILING + HEAT TRANSFER SURFACES + HEATER - CONDENSER TUBES + HEATER - EVAPORATOR TUBES + PATENTS + TUBING (METAL) + VERTICAL TUBE EVAPORATORS

30-01039 GOELDNER RW + LEITNER GF

MULTISTAGE FLASH EVAPORATOR DISTILLATION APPARATUS AND METHOD AND CONDENSER WITH SPRAY FILM EFFECTS
AQUA-CHEM, INC., WISCONSIN

U.S.PAT. 3,388,045 (10-12-64/6-11-68)

A DISTILLATION SYSTEM WITH A MULTISTAGE FLASH EVAPORATOR AND TWO SPRAY FILM EVAPORATORS FOR FEEDWATER HEATING. DUAL CONDENSER ASSEMBLIES ARE LOCATED IN EACH MULTISTAGE FLASH STAGE AND IN THE FIRST SPRAY FILM EVAPORATOR. WATER TO BE EVAPORATED IS PASSED SEQUENTIALLY THROUGH ONE OF THE CONDENSERS IN EACH OF THE MSF STAGES AND THEN INTO THE CONDENSER IN THE FIRST SPRAY FILM EVAPORATOR. THE LIQUID IS THEN SPRAYED INTO THE SECOND FILM EVAPORATOR. HEATING STEAM IS USED TO HEAT THE SECOND SPRAY FILM

ACCESSION NUMBER 30-01034 TO 30-01039

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01039 *CONTINUED*

EVAPORATOR TO EVAPORATE PART OF THE SPRAYED LIQUID. THE WATER VAPOR FROM THE SECOND SPRAY FILM EVAPORATOR IS USED TO HEAT THE FIRST SPRAY FILM EVAPORATOR. THE UNEVAPORATED LIQUID FROM THE SECOND SPRAY FILM EVAPORATOR IS SPRAYED INTO THE FIRST SPRAY FILM EVAPORATOR. A PORTION OF THE WATER UNEVAPORATED IN THE FIRST SPRAY FILM EVAPORATOR PASSES SEQUENTIALLY THROUGH THE MSF STAGES. PART OF THE WATER UNEVAPORATED AFTER PASSING THROUGH THE FLASH CHAMBERS GOES TO WASTE AND THE REMAINING PORTION PASSES SEQUENTIALLY THROUGH THE SECOND CONDENSER ASSEMBLY OF EACH STAGE OF THE FLASH EVAPORATOR AND THEN THROUGH THE SECOND CONDENSER OF THE FIRST SPRAY FILM EVAPORATOR. THIS WATER IS THEN REINTRODUCED SEQUENTIALLY THROUGH THE FLASH CHAMBERS.

*MULTISTAGE FLASH DISTILLATION + *SYSTEM DESCRIPTIONS + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + EVAPORATOR-CONDENSER SYSTEM DESIGNS + FEEDWATER HEATING + FILM EVAPORATION + FLASH EVAPORATION + FLOWSHEETS + PATENTS + SPRAY NOZZLES

30-01040 RCBINSCN ML
WATER TREATMENT

U.S.PAT. 3,332,871 (6-27-66/7-25-67)

A METHOD OF INTRODUCING WATER TREATING CHEMICALS INTO THE WATER OF A RECIRCULATING WATER SYSTEM HAVING A MAKEUP WATER INLET. SOLID WATER-DISPERSIBLE TREATING AGENT IS LOCATED IN AN OPEN-TO CONTAINER. THE CHEMICAL IS COVERED WITH A WATER-PERMEABLE DIFFUSION BARRIER RESTING ON THE SURFACE OF THE CHEMICAL. FEEDWATER IS ADMITTED TO THE TOP OF THE BARRIER AND SLOWLY PASSES THROUGH THE BARRIER AND THROUGH THE TREATING CHEMICAL. THE BARRIER REMAINS RESTING ON THE TREATING AGENT AND MOVES DOWNWARD AS THE AGENT IS CONSUMED. TREATED WATER IS WITHDRAWN FROM THE CONTAINER BELOW THE TREATING AGENT.

*COMPONENT DESIGNS + *FEEDWATER TREATMENT + *SCALE PREVENTION + CHEMICAL ADDITIVES + DISTILLATION PROCESSES + PATENTS + PRODUCT WATER TREATMENT

30-01041 CCANDA H
WATER PURIFYING APPARATUS

COANDA WATER PURIFIER CORP., N. Y.

U.S.PAT. 3,410,758 (6-8-66/11-12-68)

AN APPARATUS FOR TRANSFORMING NON-POTABLE WATER TO A POTABLE STATE INCLUDING STRUCTURE WHEREBY NON-POTABLE WATER AT A TEMPERATURE APPROACHING THE BOILING POINT EVAPORATES, DUE TO AN INCREMENTAL INCREASE IN TEMPERATURE, WHILE FLOWING AS A FILM ON A SURFACE HEATED BY THE HEAT OF CONDENSATION TO SATURATE A MOVING, FILM CONTACTING DRY AIR MASS AT SUBATMOSPHERIC PRESSURE AND WHICH SUBSEQUENT AIR-VAPOR MIXTURE IS COMPRESSED THEN PASSED TO A CONDENSING SURFACE CONTIGUOUS WITH SAID EVAPORATION SURFACE TO CONDENSE POTABLE WATER FOR COLLECTION, WITH SAID CONDENSING SURFACE PASSING TO THE EVAPORATING SURFACE ENOUGH HEAT TO CAUSE THE INCREMENTAL INCREASE IN TEMPERATURE OF THE NON-POTABLE WATER.

*COMPONENT DESIGNS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + FALLING FILM EVAPORATION + FILM EVAPORATION + HUMIDIFICATION PROCESSES + PATENTS + VAPOR COMPRESSION EVAPORATION

30-01042 OTHMER DF

METHOD FOR PRODUCING PURE WATER FROM SEA WATER AND OTHER SOLUTIONS BY FLASH VAPORIZATION AND CONDENSATION

U.S.PAT. 3,329,583 (1-18-63/7-4-67)

A MODIFICATION OF THE MULTISTAGE FLASH PROCESS TO INCLUDE A HALF STAGE AND REPLACE THE PRIME HEATER WITH A HEATER-EVAPORATOR. THE UNIT CONTINUES TO CARRY OUT THE FUNCTION OF HEATING BRINE FOR RETURN TO THE FIRST STAGE, BUT IN ADDITION, SOME OF THE BRINE EVAPORATES. IN THE HALF STAGE, THESE VAPORS ARE USED TO CONTINUE PREHEATING THE BRINE AFTER IT LEAVES THE TUBE BUNDLE OF THE FIRST STAGE. AT THE SAME TIME, HOWEVER, THE VAPORS CONDENSE, PROVIDING ADDITIONAL FRESH WATER WHICH JOINS THAT IN THE FIRST STAGE AND CONTINUES NORMALLY THROUGH THE PROCESS. THE HALF STAGE THUS CONTAINS ONLY THE COOLING TUBES AND FRESH WATER COLLECTION OF A NORMAL STAGE AND NO FLASHING BRINE. HEATED BRINE RE-ENTERS THE PROCESS IN THE FIRST STAGE, AS IT NORMALLY WOULD.

*MULTISTAGE FLASH DISTILLATION + *SYSTEM DESCRIPTIONS + DISTILLATION PROCESSES + FEEDWATER HEATING + FLASH EVAPORATION + FLOWSHEETS + HEAT RECOVERY + PATENTS

30-01043 OTHMER DF

METHOD FOR MULTI-FLASH EVAPORATION TO OBTAIN FRESH WATER FROM AQUEOUS SOLUTION

U.S.PAT. 3,288,686 (7-12-63/11-29-66), 6 FIG, 7 REF

A MODIFICATION OF THE MULTISTAGE FLASH PROCESS TO INCLUDE A HALF STAGE AND REPLACE THE PRIME HEATER WITH A HEATER-EVAPORATOR AND INCORPORATING A VAPOR REHEAT CONCEPT. THE FLOW OF THE CONDENSED FRESH WATER IS REVERSED FROM THE USUAL PROCESS, MOVING FROM LOW-TEMPERATURE TO HIGH-TEMPERATURE STAGES. ALSO, SEAWATER ENTERS THE PROCESS AT THE HOT END RATHER THAN THE COOL END. ESSENTIALLY, PRODUCT WATER, WHICH HAS BEEN EXTERNALLY COOLED, IS INTRODUCED INTO THE CONDENSING SECTION OF THE COOLEST STAGE AS A SPRAY. VAPORS FROM FLASHING BRINE CONTACT THE SPRAY AND CONDENSE, MIXING WITH THE SPRAY. THIS STEAM THEN GOES TO THE CONDENSING SECTION OF THE NEXT HOTTER STAGE AS A SPRAY. AS HOT CONDENSATE LEAVES THE HOTTEST STAGE, IT GOES TO A HEAT EXCHANGER WHERE IT PREHEATS RAW SEAWATER. THIS SEAWATER THEN FLOWS TO THE HEATER-EVAPORATOR. SOME EVAPORATES AND GOES TO THE HALF STAGE, WHILE THE REMAINDER BECOMES HOT BRINE FEEDING TO THE FIRST STAGE.

*MULTISTAGE FLASH DISTILLATION + *SYSTEM DESCRIPTIONS + *VAPOR REHEAT PROCESSES + DISTILLATION PROCESSES + FLASH EVAPORATION + FLOWSHEETS + HEAT RECOVERY + PATENTS + SPRAY NOZZLES

30-01044 ROSENBLAD AE

FALLING FILM TYPE EVAPORATORS AND METHOD

ROSENBLAD CORP., PRINCETON, N. J.

U.S.PAT. 3,307,614 (10-18-65/3-7-67)

THE APPARATUS CONSISTS OF A HEAT EXCHANGE WALL MEMBER WHICH IS FORMED FROM A NUMBER OF

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01044 *CONTINUED*

OPPOSED SHEET METAL SECTIONS SPACED IN VERTICAL SIDE BY SIDE RELATIONSHIP TO FORM AN ELONGATED ROW. ONE OF THE VERTICAL EDGES OF EACH SECTION IS JOINED TO THE OPPOSED EDGE OF THE ADJACENT SECTION TO FORM A PLEATED STRUCTURE PROVIDING A NUMBER OF SIMILAR INTERSPACES BETWEEN THE SECTIONS. THE INTERSPACES ALTERNATELY OPEN TO ONE VERTICAL SIDE AND THEN THE OTHER OF THE STRUCTURE. THE STRUCTURE IS DIVIDED INTO A SERIES OF CHAMBERS EACH CHAMBER HAVING A VAPOR SPACE ON EACH SIDE OF THE PLEATED HEAT EXCHANGE WALL. IN THE FIRST CHAMBER, HEATING STEAM IS FED TO ONE SIDE OF THE PLEATED STRUCTURE AND BRINE DISTRIBUTED ON THE OPPOSITE SIDE TO FORM AN EVAPORATING FALLING FILM. THE VAPOR FORMED FROM THE EVAPORATING BRINE IN THE FIRST CHAMBER IS USED AS THE HEATING STEAM FOR THE SECOND CHAMBER AND THIS CONTINUES FOR A NUMBER OF STAGES. THE PURE WATER CONDENSATE FROM EACH CHAMBER IS COLLECTED AND USED TO HEAT THE BRINE FEEDWATER. MEANS ARE PROVIDED TO REMOVE NON-CONDENSABLE GASES.

*EVAPORATOR-CONDENSER SYSTEM DESIGNS + *FALLING FILM EVAPORATION + *SYSTEM DESCRIPTIONS + DISTILLATION PROCESSES + EVAPORATORS + FILM EVAPORATION + FLASH CHAMBERS + HEAT EXCHANGERS + PATENTS

30-01045 MILTON RM

HEAT EXCHANGE SYSTEM

UNION CARBIDE CORP., N. Y.

U.S.PAT. 3,384,154 (5-12-64/5-21-68)

A SPECIAL HEAT EXCHANGE SURFACE TO IMPROVE THE RATE OF HEAT TRANSFER. THE APPARATUS HAS A THERMALLY CONDUCTIVE HEAT EXCHANGE WALL WITH A POROUS BOILING LAYER BONDED TO ONE SIDE OF THE WALL. THE POROUS BOILING LAYER IS CONSTRUCTED OF THERMALLY CONDUCTIVE PARTICLES BONDED TOGETHER TO FORM INTERCONNECTED PORES OF CAPILLARY SIZE HAVING AN EQUIVALENT PORE RADIUS LESS THAN ABOUT 4.5 MILS. BRINE COVERS THE POROUS LAYER AT LEAST AS A FILM AND THE OTHER SIDE OF THE WALL IS HEATED WITH STEAM OR WARM FLUID. VAPOR BUBBLES ARE FORMED WITHIN THE POROUS LAYER BY HEAT TRANSFER AND EMERGE INTO THE LIQUID FILM COVERING THE POROUS LAYER. SPACE IS PROVIDED FOR VAPOR REMOVAL.

*HEAT TRANSFER IMPROVEMENTS + *HEAT TRANSFER SURFACES + BOILING PROMOTION + DISTILLATION PROCESSES + EVAPORATORS + EXTENDED HEAT TRANSFER SURFACES + FILM BOILING + HEAT EXCHANGERS + HEAT TRANSFER + HEAT TRANSFER COEFFICIENT + PATENTS

30-01046 OTHMER DF

METHOD FOR REMOVING SCALE-FORMING CONSTITUENTS FROM SEA WATER AND OTHER SOLUTIONS WHICH FORM SCALE

U.S.PAT. 3,408,294 (6-7-67/10-29-68)

SOME SOLUBLE MATERIALS, PRINCIPALLY SALTS, IN SEA WATER AND OTHER HARD WATERS, FORM HARD, DENSE CRYSTALLINE DEPOSITS OR SCALES ON SURFACES WHEN THE SOLUTION IS HEATED TO AN ELEVATED TEMPERATURE- AND TIME IS ALLOWED FOR CRYSTALLIZATION TO TAKE PLACE. A METAL WIRE MESH MAY FILL A PART OF THE VOLUME OF A VESSEL IN WHICH THE HEATED SOLUTION IS MAINTAINED FOR 1 TO 200 MINUTES- AND SCALE IS ALLOWED TO FORM DURING THIS TIME ON THE SURFACES OF THE WIRE WHICH MAKES UP THE MESH. CHANGING THE BULK VOLUME OF THE METAL MESH BY COMPRESSION OR EXPANSION DUE TO AN EXTERNAL MECHANICAL FORCE, CAUSES THE WIRE IN THE MESH TO FLEX, AND THE SCALE TO CRACK THEREFROM, IN SOLID PARTICLES WHICH MAY READILY BE REMOVED FROM THE WATER, NOW COMPARATIVELY SOFT. IF THE WATER THEN IS TO BE EVAPORATED, THE PARTICLES MAY REMAIN IN THE LIQUID FOR FURTHER CRYSTALLIZATION THEREON AS THE CONCENTRATION PROCEEDS.

*FEEDWATER TREATMENT + *SCALE PREVENTION + DISTILLATION PROCESSES + PATENTS + SCALE REMOVAL + SCALING + SEEDING PROCESSES

30-01047 BAUER WV

DISTILLATION OF A SOLUTE-SOLVENT MIXTURE IN SUCCESSIVELY REDUCED PRESSURE STAGES WHILE IN DIRECT CONTACT AND CONCURRENT FLOW WITH A HEAT TRANSFER MEDIUM

LUMMUS CO., NEW YORK

U.S.PAT. 3,298,932 (4-25-62/1-17-67), 5 FIG, 11 REF

PROCESS AND APPARATUS COVER MULTIEFFECT VAPOR-COMPRESSION SYSTEM UTILIZING AN INTERMEDIATE HEAT-TRANSFER FLUID. THE EVAPORATOR-CONDENSER TOWER CONSISTS OF A VERTICAL CYLINDRICAL TOWER HAVING A SERIES OF VERTICALLY AND ALTERNATELY STACKED EVAPORATIVE AND CONDENSING TRAYS. UPCOMERS AND DOWNCOMERS ARE PROVIDED FOR UPFLOW OF HOT OIL AND DOWNFLOW OF COLD OIL. THE EVAPORATIVE TRAYS ACCOMMODATE HOT OIL-BRINE SUSPENSION. WATER EVAPORATES FROM THE BRINE AND THE CONCENTRATED BRINE AND THE OIL IS PASSED UPWARD TO THE NEXT EVAPORATING TRAY. THE HYDROSTATIC HEAD IN THE TOWER DECREASES AS THE MIXTURE MOVES UPWARD THUS PERMITTING ADDITIONAL EVAPORATION. AT THE TOP OF THE TOWER THE CONCENTRATED BRINE AND OIL ARE SEPARATED AND THE BRINE USED TO PREHEAT MAKEUP FEED. THE OIL FLOWS DOWN THE TOWER VIA THE CONDENSING TRAYS AND CONDENSES PURE WATER FROM THE VAPORS FROM NEARBY EVAPORATING TRAYS. AT THE BOTTOM OF THE TOWER THE PURE WATER AND OIL ARE SEPARATED. THEN THE OIL IS HEATED BY WATER VAPORS WHICH WERE OBTAINED FROM THE TOP OF THE TOWER AND PASSED THROUGH A VAPOR COMPRESSOR. THE HEATED OIL FLOWS UPWARD TO THE LOWEST EVAPORATING TRAY AT WHICH POINT PREHEATED BRINE FEEDWATER IS ADDED.

*DIRECT CONTACT HEAT EXCHANGE + *SYSTEM DESCRIPTIONS + *VAPOR COMPRESSION EVAPORATION + COMPONENT DESIGNS + DISTILLATION PROCESSES + EVAPORATOR-CONDENSER SYSTEM DESIGNS + HEAT TRANSFER + MULTIPLE EFFECT DISTILLATION + PATENTS

30-01048 LLSTENADER EL

WATER DEMINERALIZING APPARATUS

GENERAL ELECTRIC CO., NEW YORK

U.S.PAT. 3,196,087 (3-28-61/7-20-65), 7 FIG, 7 REF

AN APPARATUS FOR DEMINERALIZING WATER IN WHICH THE EVAPORATION AND CONDENSATION OCCUR AT ATMOSPHERIC PRESSURE. A SERIES OF DISCS ROTATE BETWEEN PARALLEL PLATES WITH THE DISCS CONTINUOUSLY PASSING THROUGH A HEATED SALINE FEEDWATER IN A SUMP. BECAUSE OF THE PARTIAL PRESSURE GRADIENT BETWEEN THE HEATED FEED IN THE SUMP AND THE CONDENSING SURFACE OF PARALLEL PLATES, A FILM OF PURE WATER FORMS ON THE PLATES AND IS COLLECTED.

*ROTARY STILLs + COMPONENT DESIGNS + DISTILLATION PROCESSES + EVAPORATOR-CONDENSER SYSTEM DESIGNS +

ACCESSION NUMBER 30-01044 TO 30-01048

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01048 *CONTINUED*

FILM EVAPORATION + HEAT TRANSFER SURFACES + PATENTS

30-01049 WILLIAMSON WR

MULTI-STAGE PROCESS AND APPARATUS FOR DISTILLING SEA WATER

AMERICAN MACHINE AND FOUNDRY COMPANY, INC., NEW YORK

U.S.PAT. 3,155,600 (5-16-60/11-3-64), 2 FIG, 5 REF

METHOD AND APPARATUS FOR A COMBINED DISTILLATION PLANT COUPLING A MULTIEFFECT SECTION WITH A MULTISTAGE FLASH DISTILLATION SECTION. THE FIRST OR OUT-OF-CONTACT EVAPORATING PHASE OF THE SYSTEM CONSISTS PRIMARILY OF ONE OR MORE UNITS WHICH ARE SO INTERCONNECTED AND OPERATED AS TO PROVIDE DOUBLE EFFECT OPERATION. THE SECOND PHASE OF THE SYSTEM CONSISTS PRIMARILY OF A NUMBER OF FLASH EVAPORATORS WHICH ARE INTERCONNECTED TO PROVIDE A CASCADE RELATIONSHIP. SEPARATE MEANS ARE PROVIDED FOR EACH PHASE FOR THE REMOVAL OF NONCONDENSABLE GASES. THE NONCONDENSABLE REMOVAL IS MADE IN SUCH A MANNER THAT DESIRED PRESSURE DIFFERENTIALS BETWEEN THE STAGES ARE OBTAINED AND THE GASES ARE REMOVED FROM EACH STAGE AT A RATE SUFFICIENT TO PREVENT THE ACCUMULATION OF AN UNDUE AMOUNT OF NONCONDENSABLES IN THE STAGE.

*MULTIPLE EFFECT DISTILLATION + *MULTISTAGE FLASH DISTILLATION + *NONCONDENSABLE REMOVAL + *SYSTEM DESCRIPTIONS + *CONDENSERS + *DISTILLATION PROCESSES + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + *EVAPORATORS + FLASH EVAPORATION + PATENTS

30-01050 RIS KB + GARDNER WA + RYAN JM

EVAPORATOR CONSTRUCTION

BALDWIN-LIMA-HAMILTON CORP., PHILADELPHIA

U.S.PAT. 3,194,747 (11-8-61/7-13-65), 4 FIG, 11 REF

A RECIRCULATION TYPE OF MULTISTAGE FLASH EVAPORATOR PLANT IN WHICH ALL OF THE WATER PASSING THROUGH BOTH THE EVAPORATOR AND CONDENSER CHAMBER OF THE HIGHER TEMPERATURE STAGES HAS BEEN THOROUGHLY DEAERATED. ALSO THE BRINE BEING RECIRCULATED IS INJECTED INTO THE EVAPORATOR SYSTEM AT A POINT WHICH WILL MAINTAIN THE PROPER HEAT BALANCE OF THE PLANT AND THEREBY RETAIN THE MAXIMUM EFFICIENCY. THE DEAERATION IS ACCOMPLISHED BY INTRODUCING MAKEUP SEAWATER AT THE TOP OF THE LOWEST TEMPERATURE EVAPORATOR CHAMBER. WITHIN THIS CHAMBER IS A SERIES OF VERTICALLY SPACED TRAYS AND THE MAKEUP WATER CASCADES FROM ONE TRAY TO THE NEXT AND IS HEATED AND DEAERATED BY THE VAPOR FROM THE FLASHING BRINE AT THE BOTTOM OF THE CHAMBER. SEAWATER IS USED TO COOL THE HEAT REJECTION STAGES AND THE RECIRCULATING BRINE IS INTRODUCED TO THE CONDENSER TUBES OF AN INTERMEDIATE STAGE SUCH THAT IT IS AT THE SAME TEMPERATURE AS THE COOLING SEAWATER LEAVING THE CONDENSER TUBES OF THE NEXT LOWER TEMPERATURE STAGE.

*COMPONENT DESIGNS + *DEAERATORS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + *MULTISTAGE FLASH DISTILLATION + DEAERATION + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + EVAPORATORS + FEEDWATER HEATING + FLASH EVAPORATION + FLOWSHEETS + PATENTS + SYSTEM DESCRIPTIONS

30-01051 CHALMERS TM + FRANKEL A + CRAIG HRM

MULTI-STAGE FLASH EVAPORATOR WITH HEAT RECOVERY

RICHARDSONS, WESTGARTH AND CO., LTD., ENGLAND

U.S.PAT. 3,146,177 (11-3-60/8-25-64), 2 FIG, 4 REF

THE DESIGN OF A MULTISTAGE FLASH DISTILLATION SYSTEM EVAPORATOR. THE EVAPORATOR CONSISTS OF A GROUP OF TWO OR MORE FLASH CHAMBERS, EACH OF WHICH IS CONNECTED TO AN ASSOCIATED CONDENSER BUNDLE FOR THE HEATING OF THE LIQUID TO BE EVAPORATED IN THE FLASH CHAMBERS. THE FLASH CHAMBERS IN THE GROUP ARE CONNECTED TOGETHER IN SERIES WHILE AT LEAST TWO OF THE CONDENSER TUBE BUNDLES ARE CONNECTED TOGETHER IN PARALLEL SO THAT, IN OPERATION, THE LIQUID TO BE EVAPORATED IS DIVIDED INTO A NUMBER OF PARALLEL STREAMS PRIOR TO ITS ENTRY INTO THE HEATER-CONDENSERS.

*EVAPORATOR-CONDENSER SYSTEM DESIGNS + *MULTISTAGE FLASH DISTILLATION + *SYSTEM DESCRIPTIONS + CONDENSERS + DISTILLATION PROCESSES + EVAPORATORS + FLASH CHAMBERS + FLASH EVAPORATION + FLOWSHEETS + PATENTS

30-01052 KOGAN A

PROCESS AND APPARATUS FOR EFFECTING HEAT TRANSFER

U.S.PAT. 3,242,975 (5-5-64/3-29-66)

A HEAT EXCHANGER AND A PROCESS FOR EFFECTING HEAT EXCHANGE. IMPROVED HEAT TRANSFER MAY BE EFFECTED BETWEEN A PAIR OF FLUID STREAMS, E.G. A STREAM OF WARM CONVERTED WATER RECOVERED FROM A MULTISTAGE DIRECT CONTACT EVAPORATOR AND A FEED STREAM OF COOL BRINE, BY SUCCESSIVELY EMPLOYING A TRANSPORTABLE PEBBLE BED AS A DIRECT CONTACT HEAT TRANSFER MEANS BETWEEN THE FLUID STREAMS, AND PASSING A THIRD FLUID STREAM THROUGH THE PEBBLE BED AFTER IT HAS BEEN SO UTILIZED, TO REMOVE ANY OF THE SECOND FLUID ADSORBED ON OR WETTING THE INDIVIDUAL PEBBLES AND THEREBY PROMOTE HEAT TRANSFER WITHOUT INTERMIXING OF THE FLUIDS. THE USE OF PEBBLE BED AS AN INTERMEDIATE HEAT SINK THUS PROVIDES EFFICIENT INDIRECT HEAT TRANSFER BETWEEN THE SEPARATE FLUID STREAMS AND THIS WITHOUT CONTAMINATION OF ONE STREAM WITH THE OTHER.

*COMPONENT DESIGNS + *DIRECT CONTACT HEAT EXCHANGE + *HEAT EXCHANGERS + *HEAT TRANSFER + DISTILLATION PROCESSES + PATENTS

30-01053 BRWN CE

AMBIENT TEMPERATURE VAPOR COMPRESSION DESALINATION SYSTEM

HYDRONAUTICS, INC., LAUREL MD.

U.S.PAT. 3,450,601 (4-4-67/6-17-69)

MEANS FOR PREPARING A TREATED LIQUID HAVING A DESIRED PH BY ADDING SULFURIC ACID TO SALINE WATER AND DEAERATING AND FILTERING TO SUBSTANTIALLY ELIMINATE THE CARBONATES. THEREAFTER DISTILLING THE TREATED LIQUID IN A DISTILLING APPARATUS ADAPTED TO HANDLE TREATED LIQUIDS HAVING THE DESIRED PH, AND INCLUDING A PLURALITY OF ANNULAR HORIZONTALLY ARRANGED FALLING FILM HEAT EXCHANGE UNITS, THE UNITS BEING VERTICALLY SPACED TO PROVIDE PRESSURIZING COMPARTMENTS THEREBETWEEN WHICH RECEIVES THE BLADES OF A ROTARY COMPRESSOR, THE COMPRESSOR BEING THE ONLY MOVABLE PART IN THE APPARATUS.

*COMPONENT DESIGNS + *EVAPORATOR-CONDENSER SYSTEM DESIGNS + *FALLING FILM EVAPORATION +

ACCESSION NUMBER 30-01048 TO 30-01053

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01053 *CONTINUED*

*VAPOR COMPRESSION EVAPORATION + CHEMICAL ADDITIVES + DEAERATION + DISTILLATION PROCESSES + FEEDWATER TREATMENT + PATENTS + SCALE PREVENTION

30-01054 HEINZ WR

METHOD AND APPARATUS FOR HEATING AND DISTILLING SALINE WATER USING HEATED PEBBLES

U.S.PAT. 3,442,769 (10-22-65/5-6-69)

A METHOD OF TRANSFERRING HEAT TO A SOLUTION IN WHICH SOLID MATTER IS DEPOSITED UPON THE HEAT TRANSFER MEANS, COMPRISING THE STEPS OF (1) HEATING A FLOW OF SOLID PARTICLES, (2) CAUSING THE HEATED SOLID PARTICLES TO CONTACT THE SOLUTION TO BE HEATED IN COUNTERFLOW WHEREBY SOLID MATTER FROM THE SOLUTION IS DEPOSITED UPON THE SURFACES OF THE SOLID PARTICLES, (3) ABRADING AND IMPACTING THE SOLID PARTICLES TO LOOSEN THE DEPOSITED SOLID MATTER, (4) CAUSING THE ABRADED AND IMPACTED SOLID PARTICLES TO CONTACT THE SOLUTION IN COUNTERFLOW TO WASH THE LOOSENED DEPOSITED SOLID MATTER FROM THE SOLID PARTICLES, AND (5) REHEATING THE CLEANED SOLID PARTICLES FOR FURTHER CONTACT WITH A SOLUTION TO BE HEATED.

BOILING PROMOTION + BULK BOILING + COLUMNS (PROCESS) + DISTILLATION PROCESSES + HEAT TRANSFER + PATENTS + SCALE PREVENTION + SYSTEM DESCRIPTIONS

30-01055 RANNENBERG GC

COMBINED HEAT LOAD COOLER AND SEA WATER DESALINATION STILL

UNITED AIRCRAFT CORP., EAST HARTFORD, CONN.

U.S.PAT. 3,440,147 (7-14-66/4-22-69)

SEA WATER OR CONTAMINATED WATER IS DIVIDED INTO A FIRST STREAM WHICH IS PARTIALLY VAPORIZED AND THE RESIDUE DISCARDED, AND A SECOND STREAM WHICH CONDENSES THE PRODUCED VAPOR BY INDIRECT HEAT EXCHANGE THEREWITH. THE VAPORIZATION IS BROUGHT ABOUT BY A CLOSED HEAT TRANSFER LOOP IN WHICH HEAT IS INDIRECTLY ABSORBED FROM A HEAT LOAD AT ONE LOOP POINT AND THE HEAT ABSORBED SURRenderED TO SAID VAPORIZATION AT ANOTHER LOOP POINT.

*HEAT RECOVERY + *SYSTEM DESCRIPTIONS + DISTILLATION PROCESSES + FLOWSHEETS + HEAT TRANSFER + PATENTS

30-01056 LOUW JA

DESALINATION METHOD AND APPARATUS WITH PLURAL VAPORIZATION CHAMBER CONTAINING SHALLOW LAYERS OF LIQUID

U.S.PAT. 3,440,146 (5-2-66/4-22-69)

A DESALINATION METHOD AND APPARATUS INCLUDES A NUMBER OF SERIES-CONNECTED HEAT EXCHANGERS EACH INCLUDING AN EVAPORATION CHAMBER AND A CONDENSATION CHAMBER. A NUMBER OF SPACED-APART HEAT-CONDUCTIVE MEMBERS EXTEND INTO THE EVAPORATION CHAMBER THROUGH THE MAJOR PORTION OF THE DEPTH OF A SHALLOW HORIZONTAL LAYER OF SALINE WATER IN THE CHAMBER. THE PRESSURE OF THE CONDENSING VAPOR AND THE SALINE WATER IN RELATION TO THE DEPTH OF THE SALINE WATER LAYER IS REGULATED SO THAT THE MAJOR PORTION OF THE SURFACE OF EACH HEAT-CONDUCTIVE MEMBER IS IN CONTACT WITH BOILING WATER.

*EVAPORATOR-CONDENSER SYSTEM DESIGNS + *SYSTEM DESCRIPTIONS + DISTILLATION PROCESSES + EVAPORATORS + FLASH CHAMBERS + FLASH EVAPORATION + HEAT TRANSFER SURFACES + PATENTS

30-01057 SAAVEDRA MA

SYSTEM FOR CONVERSION OF SEA WATER INTO FRESH WATER

FARBWERKE HOECHST AKTIENGESELLSCHAFT, GERMANY

U.S.PAT. 3,438,869 (1-13-67/4-15-69)

THIS INVENTION RELATES TO A METHOD AND APPARATUS FOR PRODUCING FRESH WATER FROM SEA WATER WHEREIN HYDROGEN AND OXYGEN ARE BURNED AT A PRESSURE LESS THAN ATMOSPHERIC PRESSURE TO COMPLETELY VAPORIZE A BRINE SOLUTION. THE VAPORS ARE THEN PASSED THROUGH COILS MAINTAINED IN A VACUUM AND ARE THEN PASSED INTO A CONDENSATION CHAMBER MAINTAINED AT REDUCED TEMPERATURE AND PRESSURE TO CONDENSE LIQUID WATER CONTAINING THE IMPURITIES, AND SEPARATE SAID LIQUID CONTAINING IMPURITIES FROM THE PURE WATER VAPOR. THE FRESH WATER IS RECOVERED BY CONDENSATION.

*SYSTEM DESCRIPTIONS + DISTILLATION PROCESSES + ENERGY SOURCES + FEEDWATER HEATING + FLASH EVAPORATION + MULTISTAGE FLASH DISTILLATION + PATENTS

30-01058 LAURENTY F

SPRAY TYPE FLASH EVAPORATOR

U.S.PAT. 3,434,522 (9-21-66/3-25-69)

AN EVAPORATOR VESSEL HAS A DELIVERY PIPE IN ITS UPPER SECTION, COMPRISING A HORIZONTAL, CIRCULAR TUBULAR SECTION, AND A TUBULAR SPOUT WHOSE LOWER FACE IS UPWARDLY INCLINED WITH RESPECT TO THE AXIS OF THE TUBULAR SECTION. THE SPOUT HAS A TOP PORTION WHICH IS FLAT AND DISPOSED IN A HORIZONTAL PLANE TANGENT TO THE UPPERMOST ELEMENT OF THE TUBULAR SECTION. THE INCLINED BOTTOM PORTION OF THE SPOUT HAS A SERIES OF DISCHARGE NOZZLES THEREALONG.

*COMPONENT DESIGNS + *EVAPORATORS + *FLASH EVAPORATION + DISTILLATION PROCESSES + EVAPORATOR SYSTEM DESIGN + PATENTS + SPRAY NOZZLES

30-01059 RALSTON PH

SCALE INHIBITING

CALGON CORP.

U.S.PAT. 3,434,969 (8-11-67/3-25-69)

COMPOUNDS CONTAINING A PLURALITY OF METHYLENE PHOSPHONATED AMINE GROUPS HAVING AT LEAST THREE NITROGENS CONNECTED BY ETHYLENE GROUPS ARE DISCLOSED TO INHIBIT THE FORMATION OF SCALE, SUCH AS CALCIUM, BARIUM AND MAGNESIUM CARBONATE, SILICATE AND SULPHATE SCALES, FROM AQUEOUS SOLUTIONS, EVEN AT RELATIVELY HIGH TEMPERATURES, AT THRESHOLD INHIBITOR CONCENTRATIONS.

*CHEMICAL ADDITIVES + *FEEDWATER TREATMENT + *SCALE PREVENTION + DISTILLATION PROCESSES + PATENTS + SCALING

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01060 LOEBEL FA
MULTISTAGE FLASH STILL WITH VAPOR COMPRESSION PLANT
AQUA-CHEM, INC., WIS.
U.S.PAT. 3,433,717 (3-1-65/3-18-69)

A VAPOR COMPRESSION PLANT HAVING A MULTI-STAGE FLASH EVAPORATOR SERVING AS A BRINE PREHEATER FOR A VAPOR COMPRESSION EVAPORATOR AND COMPRESSOR. THE MULTI-STAGE FLASH EVAPORATOR CAN BE DIVIDED INTO A HEAT REJECTION SECTION AND A HEAT REGENERATIVE SECTION. A HEAT EXCHANGER SERVES TO PREHEAT MAKE UP WATER BY EXTRACTING HEAT FROM THE DISTILLATE PRIOR TO ADDING THE PREHEATED MAKE UP WATER TO AN INTERMEDIATE STAGE OF THE MULTI-STAGE FLASH EVAPORATOR. THE PREHEATED WATER ENTERING THE VAPOR COMPRESSION EVAPORATOR SUBSTANTIALLY INCREASES THE DISTILLATE PRODUCING CAPACITY OF THE PLANT.

*MULTISTAGE FLASH DISTILLATION + *SYSTEM DESCRIPTIONS + *VAPOR COMPRESSION EVAPORATION + FLASH EVAPORATION + FLOWSHEETS + PATENTS + PREHEATER SECTIONS

30-01061 KANAAN ZR
SPRAY-TYPE DISTILLATION USING GAS TURBINE EXHAUST DISTILL AND HEATING
GENERAL MOTORS CORP., DETROIT
U.S.PAT. 3,425,914 (10-26-66/2-4-69)

A PLANT FOR GENERATING USEFUL POWER AND PROVIDING FRESH WATER FROM SALT WATER INCLUDES A GAS TURBINE ENGINE WHICH DRIVES A GENERATOR, A SPRAY CHAMBER THROUGH WHICH THE TURBINE EXHAUST GAS IS PASSED AND INTO WHICH SALT WATER IS SPRAYED, AND A CONDENSER COOLED BY THE SALT WATER TO CONDENSE FRESH WATER FROM THE TURBINE EXHAUST.

*DIRECT CONTACT HEAT EXCHANGE + *GAS TURBINES + *HEAT RECOVERY + DISTILLATION PROCESSES + ENERGY SOURCES + EVAPORATOR-CONDENSER SYSTEM DESIGNS + FLOWSHEETS + FOSSIL FUELS + PATENTS + SPRAY NOZZLES + SYSTEM DESCRIPTIONS + TURBINE-GENERATORS + WASTE HEAT BOILERS

30-01062 HENDERSON GL
SELECTED FILM VELOCITY DISTILLATION
U.S.PAT. 3,414,483 (1-27-66/12-3-68)

A METHOD FOR EVAPORATING BRINE WHICH CONSISTS OF PASSING PREHEATED FEEDWATER DOWNWARDLY AS A FLOWING FILM OVER A HEAT TRANSFER WALL, PASSING STEAM INTO CONTACT WITH THE OPPOSITE SIDE OF THE WALL AT 3 TO 15 DEG F ABOVE THE TEMPERATURE OF THE FLOWING FILM, AND CONDENSING AT LEAST A PORTION OF THE STEAM AS A FILM ON THE OPPOSITE SIDE. THE CONDENSATE FILM IS PREVENTED FROM BUILDING UP TO A THICKNESS OF MORE THAN 0.005 IN. THE BRINE FILM IS MAINTAINED AT A DOWNWARD VELOCITY AT THE UPPERMOST HEAT TRANSFER LEVEL OF THE WALL AT LEAST EQUIVALENT TO THE VELOCITY ACHIEVED BY A FREE FALLING FILM ON A SMOOTH VERTICAL WALL AFTER A FALL OF ABOUT 3 FT. BRINE IS EVAPORATED AT THE RATE OF 10 TO 30 LB/HR SQ FT OF HEAT TRANSFER WALL.

*EVAPORATOR-CONDENSER SYSTEM DESIGNS + *FALLING FILM EVAPORATION + DISTILLATION PROCESSES + EVAPORATORS + FILM EVAPORATION + HEAT TRANSFER SURFACES + PATENTS + SYSTEM DESCRIPTIONS

30-01063 GEIRINGER PL
HIGH TEMPERATURE WATER JET COMPRESSION - A METHOD FOR PROVIDING COST REDUCTION IN ALL SALINE WATER DISTILLATION PROCESSES
AMERICAN HYDROTHERM CORP., NEW YORK
PAGES C-22-32 IN PROC. WESTERN WATER POWER SYMP., LOS ANGELES, APR. 1968, WESTERN PERIODICALS, NORTH HOLLYWOOD, CALIF. (1968), 9 FIG, 13 REF

THIS PAPER DISCUSSES FROM A GENERAL THERMOECONOMIC POINT OF VIEW THE ENERGY AVAILABLE WHICH CAN BE CONVERTED INTO WORK. ALL DISTILLATION PROCESSES REQUIRE FOR EACH STEP NOT ONLY TRANSFER OF HEAT BUT ALSO EXPENDITURE OF WORK. WITHOUT THIS MECHANICAL WORK, ALSO CALLED AVAILABLE ENERGY OR EXERGY, NO HEAT IS TRANSFERABLE. IT IS SHOWN HOW THE NARROW EXERGY RANGE PRESENTLY AVAILABLE FOR DESALINATION DISTILLATION CAN BE EXTENDED BY UTILIZING COMPRESSION DISTILLATION, ESPECIALLY HIGH TEMPERATURE WATER JETS. THE ADVANTAGES OF THIS COMPRESSION METHOD, ITS APPLICATION FOR DESALINATION PURPOSES, AND TESTS CONDUCTED WITH THE JET ARE DESCRIBED.

*ENERGY CCSTS + *THERMODYNAMIC ANALYSIS + *THERMODYNAMICS + CAPITALIZED COSTS + DISTILLATION PROCESSES + OPERATING COSTS + TURBINES + VAPOR COMPRESSION EVAPORATION

30-01064 TIDBALL RA + GAYDOS JG + KING WM
OPERATING EXPERIENCES OF ONE MGD DESALINATION PLANT ON THE RED SEA
BALDWIN-LIMA-HAMILTON CORP., PHILADELPHIA
PAGES C-43-50 IN PROC. WESTERN WATER POWER SYMP., LOS ANGELES, APR. 1968, WESTERN PERIODICALS, NORTH HOLLYWOOD, CALIF. (1968), 6 FIG, 2 REF

A 1-MGD DESALTING PLANT OPERATING SINCE 1965 IN CONJUNCTION WITH A 6700 KW STEAM GENERATING STATION IN EILAT IS DESCRIBED. SPECIFICATIONS FOR THE PLANT REQUIRED PRODUCTION OF 8 LBS OF STEAM WITH LESS THAN 25 PPM TDS FOR EACH LB OF STEAM USED IN THE BRINE HEATER. MAXIMUM TEMPERATURE OF THE RECYCLE STEAM WAS TO BE 200 DEG F AND CALCIUM CARBONATE SCALE WAS TO BE CONTROLLED WITH SODIUM POLYPHOSPHATE. THIS SCALE CONTROL METHOD PROVED UNSATISFACTORY IN OPERATION, HOWEVER, AND CONVERSION WAS MADE TO A MORE SATISFACTORY ACID TREATMENT SYSTEM. FROM DECEMBER 1965 TO DECEMBER 1966, THE PLANT PRODUCED 349 MILLION GALLONS OF PRODUCT WATER, OR 93% OF THE DESIGN CAPACITY, ON A CONTINUOUS BASIS. FROM JANUARY 1967 TO THE PRESENT, THE PLANT HAS AVERAGED ABOUT 105% OF DESIGN. DURING ONE SHORT PERIOD, IT WAS DEMONSTRATED THAT THIS PLANT COULD BE OPERATED AT 230 DEG F, PRODUCING MORE THAN 1.25 MGD.

*CORROSION CONTROL + *OPERATING EXPERIENCE + *OPERATIONAL PROBLEMS + CORROSION + DESIGN + DISTILLATION PROCESSES + DISTILLATION PROCESSES + ISRAEL + PHYSICAL CHEMISTRY OF SCALE + SCALE PREVENTION + SCALE REMOVAL + SCALING + SPECIFICATIONS + 0-50 MGD PLANT

30-01066 HUNTER JA + SAVAGE WF
THE U.S. DESALTING PROGRAM
OFFICE OF SALINE WATER, WASHINGTON, D.C.
DESALINATION 6(3), 285-86 (1969)

THE U.S. GOVERNMENT DESALTING PROGRAM INCLUDES (1) BASIC AND APPLIED RESEARCH, (2) DESIGN, CONSTRUCTION, AND OPERATION OF PILOT PLANTS OF 75,000 GPD OR LESS, (3)

ACCESSION NUMBER 30-01060 TO 30-01066

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01066 *CONTINUED*

OPERATION OF 1-MGD TEST BEDS, (4) CONSTRUCTION AND OPERATION OF LARGE WATER PLANT MODULES, AND (5) DEVELOPMENT OF SUPPORTING TECHNOLOGY IN SUCH AREAS AS MATERIALS, WATER PRETREATMENT, AND BRINE DISPOSAL. TEST FACILITIES INCLUDE A 1-MGD MSF TEST BED PLANT, A 2.5-MGD MSF MODULE, A 1-MGD VC TEST BED PLANT, A 1-MGD VTE TEST BED PLANT, A 250,000-GPD ELECTRODIALYSIS TEST BED PLANT, A MATERIALS TEST CENTER, A BRACKISH WATER TEST CENTER, AND A NUMBER OF PILOT PLANTS FOR DEVELOPMENT OF DISTILLATION, MEMBRANE, AND CRYSTALLIZATION PROCESSES. UNDER CONSIDERATION NOW IS A 4-MGD VTE MODULE USING MSF BRINE PREHEATING. IN ADDITION TO ITS BASIC FUNCTION OF ACCELERATING DEVELOPMENT AND DEMONSTRATION OF DESALTING TECHNOLOGY IN THE U.S., PROGRAM POLICY PERMITS PROMPT AND FREE FLOW OF INFORMATION TO ALL OTHER COUNTRIES, ENCOURAGING ADVANCEMENT OF DESALTING ON AN INTERNATIONAL BASIS. IT IS BELIEVED THAT THE U.S. PROGRAM HAS CONTRIBUTED SIGNIFICANTLY TO BRINGING DESALTING TECHNOLOGY TO THE POINT WHERE ECONOMIC SOLUTIONS TO MUNICIPAL AND INDUSTRIAL WATER SUPPLY PROBLEMS ARE ASSURED AND WHERE DESALTED WATER FOR LIMITED AGRICULTURAL APPLICATIONS MUST BE SERIOUSLY CONSIDERED.

*PILOT PLANT OPERATIONS + *REVIEWS + DESIGN + DEVELOPMENT + DISTILLATION PROCESSES + OPERATING EXPERIENCE + OSW SPONSORED + PLANT CONSTRUCTION + STATUS REPORTS

30-01067 FLINT D

SCALES FROM PHOSPHATE TREATED SEA WATER

U.K. ATOMIC ENERGY AUTHORITY, HARWELL, ENGLAND

DESALINATION 6(3), 319-34 (1969), 3 FIG, 12 REF

AS A STEP TOWARD IMPROVED EFFICIENCY OF DESALINATION PLANTS, A STUDY WAS MADE OF THE COMPOSITION, STRUCTURE, AND MODE OF GROWTH OF HEAT BARRIERS SUCH AS SCALES, SLIMES, AND SLUDGES ON HEAT TRANSFER SURFACES. THE REACTION OF SEAWATER WITH SODIUM TRI-POLYPHOSPHATE, A COMPOUND FOUND IN HAGEVAP SEAWATER PHOSPHATE ADDITIVE, WAS EXAMINED. THE PRECIPITATES, IN FRESH AND FULLY HYDROLYSED FORMS, WERE EXAMINED BY X-RAY POWDER DIFFRACTION ANALYSIS. CONSTITUENT COMPOUNDS WERE IDENTIFIED IN THE POWDER PATTERNS AND COMPARED WITH PATTERNS OF INDUSTRIAL PHOSPHATE SCALES AND SLUDGES. THE POWDER PATTERN FOG OR DIFFUSE HALO COMMONLY ASSOCIATED WITH SUCH SCALES WAS RE-EXAMINED AND FOUND TO CONTAIN DETAIL SUFFICIENT TO SHOW THAT THE COMPOSITION OF THE COMMONEST PHOSPHATE SCALE LIKELY TO BE ENCOUNTERED IS PREDOMINANTLY A NATURAL FORM OF CALCIUM PHOSPHATE, BETA-CALCIUM ORTHOPHOSPHATE, OR WHITLOCKITE.

*HEAT TRANSFER + *PHYSICAL CHEMISTRY OF SCALE + *PRECIPITATES + *PRECIPITATION + *SCALING + *SEAWATER CHEMICAL ANALYSIS + FEEDWATER TREATMENT + HEAT TRANSFER IMPROVEMENTS + HEAT TRANSFER SURFACES + REACTIONS (CHEMICAL) + SCALE PREVENTION + SCALE REMOVAL

30-01068 ZUCKERMAN N

THE EILAT 1,000,000 GPD MULTI-STAGE FLASH DISTILLATION PLANT - THIRD YEAR OF OPERATION

THE ISRAEL ELECTRIC CORP., LTD., HAIFA

DESALINATION 6(3), 309-17, 5 FIG, 3 TABLES

A DESCRIPTION OF THE THIRD YEAR OF OPERATION OF THE EILAT PLANT. OPERATING PARAMETERS WERE KEPT NEAR THE VALUES DETERMINED BY EARLIER TESTS (95-97 DEG C TOP BRINE TEMPERATURE AND 1800-1810 TONS/HR RECYCLE FLOW), MAKING IT POSSIBLE TO KEEP THE BRINE PH VALUE AT 7.2 AVERAGE, WITH RESULTING LOW CORROSION FIGURES AND LITTLE FOULING. REMARKABLY GOOD OPERATING RESULTS WERE OBTAINED, THE PLANT YEARLY AVAILABILITY FACTOR BEING 95%, YEARLY LOAD FACTOR 100.4% AND OUTPUT FACTOR 105.7%. SALINITY WAS CONSISTENTLY BELOW 3 PPM. CHEMICAL CLEANING ON RECYCLE CUT CLEANING TIME TO A FEW HOURS. AVERAGE CORROSION WAS MEASURED BY CORRATOR CELL AND BY ULTRASONICS. CASES OF LOCAL CORROSION AND PERFORATIONS ARE DESCRIBED, AS WELL AS SELF CLEANING OF TUBES BY SAND DURING SEA STORMS. PLANS FOR THE FUTURE ARE OUTLINED. INTENDED EXPERIMENTS AND IMPROVEMENTS INCLUDE (1) CATHODIC PROTECTION OF THE WATER BOXES, (2) STUDY OF PROTECTIVE COATINGS, (3) REMOVAL FOR INSPECTION OF SAMPLE CONDENSER TUBES, AND (4) EXPERIMENTATION WITH OTHER TUBE MATERIALS.

*ISRAEL + *MULTISTAGE FLASH DISTILLATION + *OPERATING EXPERIENCE + *0-50 MGD PLANT + BRINE FLOW + CORROSION + CORROSION CONTROL + DISTILLATION PROCESSES + FLASH EVAPORATION + FOULING + LOAD FACTOR + OPERATIONAL PROBLEMS + PH CONTROL + PITTING (CORROSION) + PLANT FACTOR + SCALE REMOVAL

30-01069 PORTEOUS A

A LOW TEMPERATURE MODEL FOR EQUILIBRATION RATES IN FLASHING FLOW AND ITS DESIGN IMPLICATIONS

UNIVERSITY OF GLASGOW, SCOTLAND

DESALINATION 6(3), 337-47, 4 FIG, 8 REF

THE RATE AT WHICH FLASHING BRINE ATTAINS EQUILIBRIUM IS EXAMINED AND A MODEL DEVELOPED FROM PREVIOUSLY PUBLISHED DATA ON BRINE FLASHING RATES. THE MODEL PREDICTS THAT FLASHING IS AN EXPONENTIAL DECAY PROCESS AND CORRELATES EXISTING DATA FOR BRINE TEMPERATURES OF 100 TO 150 DEG C. FLASH CHAMBER DESIGN IS EXAMINED ON THE BASIS OF THE MODEL AND A NOVEL CONCEPT IN PLANT DESIGN OBTAINED, BASED ON THE PRINCIPLE OF UNEQUILIBRATED BRINE FLOW, WHICH LEADS TO MUCH SHORTER STAGE LENGTHS FOR THE SAME STAGE YIELD.

*BRINE SYSTEM DESIGNS + *DESIGN + *DESIGN DATA + *FLASH CHAMBERS + BRINE FLOW + DESIGN CRITERIA + DISTILLATION PROCESSES + EVAPORATOR-CONDENSER SYSTEM DESIGNS + EVAPORATORS + EVAPORATORS + FLASH EVAPORATION

30-01071 BELL WE + BRAMER HC

MATERIALS EVALUATION PROGRAM

CYRUS WM. RICE AND CO., PITTSBURGH, PA.

OSW R+D PROGR. REPT. NO.308 (NOV.1967), 75 P, 13 FIG, 7 TABLES, 6 REF

MATERIALS PERFORMANCE BY VISUAL, NONDESTRUCTIVE, AND DESTRUCTIVE TEST METHODS WAS EVALUATED DURING EXTENDED FREEPORT PLANT OUTAGE. EVAPORATOR TUBES OF CUPRONICKEL (90/10), TITANIUM, AND 316 SS CAN BE EXPECTED TO GIVE LONG-TERM FAILURE-FREE SERVICE. ALUMINUM BRASS PERFORMED WELL AT LOW AND HIGH TEMPERATURES BUT PITTED AT INTERMEDIATE TEMPERATURES. TYPE 304 SS TUBING WAS UNSATISFACTORY AT HIGH TEMPERATURES. ALUMINUM BRASS HEAT EXCHANGER TUBES WERE IN GOOD CONDITION AFTER ONE YEAR. ADMIRALTY EXCHANGER

ACCESSION NUMBER 30-01066 TO 30-01071

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01071 *CONTINUED*

TUBES IN LOW-TEMPERATURE AERATED SEAWATER SHOWED THINNING BUT SCALED AT HIGH TEMPERATURES. CUPRONICKEL (90/10) TUBES EXHIBITED NO FAILURES IN EXCHANGERS. SEVERAL COA 194 TUBES SHOWED GOOD BEHAVIOR. SCALE ANALYSES WERE MADE ON DEPOSITS FROM NUMEROUS TUBES. WATER BOX LINERS OF 316 SS AND CUPRONICKEL (90/10) WERE IN EXCELLENT CONDITION. UNPROTECTED OR EPOXY-COATED STEEL WATER BOXES AND TUBE SHEETS CORRODED AND PITTED SEVERELY. CATHODIC PROTECTION OF STEEL HEAT-EXCHANGER WATER BOXES MINIMIZED CORROSION. POLYPROPYLENE EVAPORATOR WEIRS EXHIBITED MINOR DETERIORATION. STEEL BRINE SUMPS SHOWED MODERATE CORROSION AND PITTING WHICH DECREASED IN INTENSITY WITH DECREASING TEMPERATURES. EPOXY-COATED STEEL DEAERATOR PITTED DEEPLY AT LIQUID-GAS INTERFACE. SEAWATER AND BRINE STEEL PIPING WERE SCALED BUT CORROSION WAS UNIFORM. PROCEDURES FOR HANDLING, STORING, AND RETRIEVING MATERIALS PERFORMANCE DATA WERE DEVELOPED.

*CATHODIC PROTECTION + *COPPER ALLOYS + *CORROSION PROBLEMS + *FREEPORT PLANT + *IRON ALLOYS + *TUBING (METAL) + EQUIPMENT FAILURES + EVAPORATORS + HEAT EXCHANGERS + OSW SPONSORED + PHYSICAL CHEMISTRY OF SCALE + PIPELINES + PITTING (CORROSION) + PROGRAMS (COMPUTERS) + PROTECTIVE COATINGS + STAINLESS STEELS + SYNTHETIC RESINS (PLASTICS) + TITANIUM

30-01073 FOURTH ANNUAL REPORT, VAPOR COMPRESSION TEST BED PLANT, ROSWELL, NEW MEXICO WESTINGHOUSE ELECTRIC CORP., ORANGE, CALIF.

OSW R+D PROGR. REPT. NO.362 (JULY 1968), 168 P, 57 FIG, 13 TABLES

AN OPERATIONAL AND MAINTENANCE PROGRESS REPORT FROM JULY 1966 THROUGH JUNE 1967. IN A PRELIMINARY RUN, THE ION EXCHANGE AND DEGASIFIER PERFORMANCE WERE EVALUATED AND INSTRUMENTATION RELIABILITY, SCALING, FOULING AND PLUGGING PROBLEMS WERE STUDIED. IN DEVELOPMENT RUN A, INFORMATION PURSUANT TO SCALING, CORROSION, AND IMPROVEMENT OF THE DEGASIFIER SYSTEM WAS OBTAINED. IN DEVELOPMENT RUN B, THE USE OF SCREENS TO REDUCE TUBE FOULING AND PLUGGING WAS ATTEMPTED, A TEMPERATURE TRAVERSE ACROSS THE TOP OF THE TUBE SHEETS WAS OBTAINED AND THE SEED SLURRY SYSTEM FOR SCALE CONTROL WAS OPERATED. SECTIONS ON CORROSION, PLANT EQUIPMENT AND MAINTENANCE, FAILED TUBES AND A PLANT CONDITION SURVEY ARE INCLUDED.

*DEAERATION + *OPERATING EXPERIENCE + *OPERATIONAL PROBLEMS + *PILOT PLANT OPERATIONS + *ROSWELL PLANT + *VAPOR COMPRESSION EVAPORATION + CARBON DIOXIDE REMOVAL + COATINGS + COMPONENT TESTING + CORROSION PROBLEMS + DEAERATORS + EXPERIMENTAL DATA + FEEDWATER TREATMENT + INSTRUMENTATION + ION EXCHANGERS + MAINTENANCE + OSW SPONSORED + SCALE PREVENTION + SEEDING PROCESSES + TEMPERATURE MEASURING INSTRUMENTS + VAPOR COMPRESSORS

30-01078 WARNOCK RV + STETSON AR
EVALUATION OF TITANIUM-PLATED STEEL IN A CHLORIDE ENVIRONMENT
INTERNATIONAL HARVESTER CO., SAN DIEGO, CALIF.

OSW R+D PROGR. REPT. NO.395 (JAN.1969), 68 P, 29 FIG, 22 TABLES, 17 REF

DEPOSITION OF TITANIUM COATINGS ON LOW-CARBON STEELS WAS ACCOMPLISHED BY BOTH ELECTROLYTIC AND NONELECTROLYTIC TECHNIQUES. NONELECTROLYTIC COATINGS WERE DEPOSITED AT 1700 DEG F AND ELECTROLYTIC COATINGS WERE APPLIED AT 1550 DEG F AND 1.0 AMPERE/SQ. IN. CURRENT DENSITY. THE SURFACE CONCENTRATION OF THE 0.003-IN. THICK COATINGS WAS 95% OR GREATER TITANIUM AND 5% OR LESS IRON. BOILING SEAWATER, AERATED, ROOM TEMPERATURE SEAWATER, AUTOCLAVE (280 DEG F) AND VELOCITY EFFECTS CORROSION TESTS SHOWED THE NONELECTROLYTIC 0.003-IN.-THICK COATING TO POSSESS A CORROSION RESISTANCE ESSENTIALLY EQUAL TO THAT OF PURE (A-70) TITANIUM. THE RATE OF COATING DEPOSITION WAS FOUND TO BE OF PRIME IMPORTANCE IN DETERMINING CORROSION RESISTANCE BECAUSE THE DEPOSITION RATE LARGELY CONTROLS THE COATING COMPOSITION (ALLOY VERSUS INTERMETALLIC COMPOUND).

*CORROSION TESTS + *EXPERIMENTAL DATA + *PROTECTIVE COATINGS + *TITANIUM + CLADDING + COATINGS + FABRICATION METHODS + MATERIALS AND SUPPLIES COSTS + OSW SPONSORED + TITANIUM ALLOYS

30-01079 VAALER LE + DESAI SV
SCALE CONTROL WITH GRAPHITE HEAT-TRANSFER TUBES OF CONTROLLED PERMEABILITY TO STEAM - PHASE II
UNION CARBIDE CORP., PARMA, OHIO

OSW R+D PROGR. REPT. NO.396 (OCT. 1968), 16 P, 7 FIG, 5 TABLES

STUDIES WERE CONDUCTED TO EVALUATE THE ABILITY OF GRAPHITE TUBES WITH CONTROLLED PERMEABILITY TO PREVENT SCALE FORMATION IN LONG TUBE VERTICAL EVAPORATORS. A 2-IN.-O.D. BY 1.5-IN.-I.D. TUBE WAS TESTED AT VAPORIZATION TEMPERATURES OF 212 DEG F AND 265-271 DEG F. COMPARISON OF DATA AND PHYSICAL OBSERVATION OF THE TUBES REVEALED A REDUCTION OF CALCIUM SULFATE SCALE FORMATION WAS OBTAINED WITH THE POROUS GRAPHITE TUBE AS COMPARED TO AN IMPERVIOUS TUBE. THERE WAS NO REDUCTION IN THE FORMATION OF ALKALINE SCALE (CALCIUM CARBONATE AND MAGNESIUM HYDROXIDE).

*GRAPHITE + *HEAT TRANSFER + *POROUS MATERIALS + *SCALE PREVENTION + EXPERIMENTAL DATA + FALLING FILM EVAPORATION + HEAT TRANSFER IMPROVEMENTS + HEATER - EVAPORATOR TUBES + OSW SPONSORED + VERTICAL TUBE EVAPORATORS

30-01080 MCCUTCHAN JW + SIEDER EN
SCALE CONTROL IN SALINE WATER EVAPORATORS - A REVIEW OF CURRENT STATUS
UNIV. OF CALIFORNIA, LOS ANGELES + OFFICE OF SALINE WATER, WASHINGTON

OSW R+D PROGR. REPT. NO.411 (APR.1969), 62 P, 13 FIG, 3 TABLES, 44 REF

CONDITIONS FOR SCALE-FREE OPERATION ARE NOTED BASED ON OPERATING EXPERIENCE AT FREEPORT, TEX., SAN DIEGO, CALIF., AND WRIGHTSVILLE BEACH, N.C. CURRENTLY OPERATING LIMITATIONS ARE SET BY THE SOLUBILITY OF CALCIUM SULFATE. THE MULTISTAGE FLASH PROCESS IS NOTED AS THE FIRST SUCCESSFUL SCALE-FREE DESIGN, BUT RECENT DEVELOPMENT IN THE MULTIEFFECT FALLING FILM DESIGN HAS DEMONSTRATED THAT THIS HARDWARE CAN ALSO BE OPERATED SCALE FREE. METHODS FOR CHEMICAL CLEANING OF VARIOUS TYPES OF SCALE AND AREAS WHERE SCALE PROBLEMS STILL EXIST ARE DISCUSSED. THIS POINTS OUT THE NEED FOR OPTIMUM METHODS OF CHEMICAL CLEANING.

*SCALE PREVENTION + *SCALE REMOVAL + BRINE CONCENTRATION RATIO + EVAPORATORS + FEEDWATER TREATMENT + FREEPORT PLANT + HEAT TRANSFER + ION EXCHANGERS + OSW SPONSORED + PHYSICAL CHEMISTRY OF SCALE + POINT LOMA PLANT + PROPERTIES OF SCALE + REVIEWS + ROSWELL PLANT + WRIGHTSVILLE BEACH PLANT

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01082 MORAN FJ

THE FABRICATION OF SMOOTH TUBES FOR LARGE MULTISTAGE FLASH EVAPORATOR DESALINATION PLANTS
OAK RIDGE NATIONAL LABORATORY, TENN.

ORNL-TM-2750 (NOV.1969), 169 P, 8 FIG

THIS REPORT COVERS THE STATE OF THE ART OF TUBING FABRICATION, INDUSTRIAL CAPACITY TO PRODUCE TUBES, AND POSSIBLE IMPROVEMENTS IN TECHNOLOGY TO REDUCE COSTS. THE PRESENT COPPER TUBING OUTPUT IS ABOUT ONE BILLION LB/YR AND IS PRODUCED WITH HIGH-SPEED TUBE REDUCERS AND BULL BLOCKS. COPPER-ALLOY TUBES FOR CONDENSER SERVICE AMOUNT TO 150 MILLION LB/YR, GENERALLY PRODUCED WITH SLOWER AND LESS ECONOMICAL BENCH DRAWING EQUIPMENT. PRODUCTION TESTS DEMONSTRATED THE FEASIBILITY OF PROCESSING COPPER-NICKEL TUBES ON THE SAME FACILITIES USED TO PRODUCE COPPER TUBING. PRESENT FABRICATION COSTS FOR SEAMLESS COPPER-NICKEL TUBING AVERAGE WELL ABOVE \$.50/LB WITH BENCH DRAWING EQUIPMENT, BUT COULD PROBABLY BE REDUCED TO APPROXIMATELY \$.20/LB IN AN ADVANCED-TECHNOLOGY FACILITY PRODUCING THREE MILLION POUNDS OF TUBING PER MONTH. COPPER-NICKEL TUBES CAN BE FABRICATED BY WELDING FLAT STRIPS INTO TUBULAR SHAPE BUT OVER THE LONG TERM, SEAMLESS TUBING WILL PROBABLY BE CHEAPER. THE FABRICATION OF THIN-WALL SEAMLESS TITANIUM TUBES BY COLD REDUCTION IS UNECONOMICAL, AND HIGH-FREQUENCY WELDING OF FLAT STRIPS INTO TUBULAR SHAPE IS MORE PROMISING. EDDY CURRENT TESTING WAS RELIABLE FOR DETECTION OF FLAWS IN SEAMLESS TUBES. MORE WORK, HOWEVER, IS NEEDED TO IMPROVE THE RELIABILITY OF THE TEST AS APPLIED TO WELDED TUBES.

*CONDENSERS + *COPPER ALLOYS + *FABRICATION METHODS + *HORIZONTAL TUBE EVAPORATORS + *TITANIUM + *TUBING (METAL) + COMPONENT COSTS + ECONOMIC EVALUATIONS + METAL DRAWING + METAL ROLLING + OSW SPONSORED + WELDING

30-01084 JOHNSSON KO

INDEX TO RESEARCH AND DEVELOPMENT PROGRESS REPORTS PUBLISHED BY THE OFFICE OF SALINE WATER
OAK RIDGE NATIONAL LABORATORY, TENN.

ORNL-TM-2348 (REV.1), DEC.1969, 72 P

A PERMUTED INDEX OF THE TITLES, AUTHORS, COMPANIES, AND NUMBERS OF THE APPROXIMATELY 475 RESEARCH AND DEVELOPMENT PROGRESS REPORTS ISSUED BY THE OFFICE OF SALINE WATER, U.S. DEPARTMENT OF THE INTERIOR, THROUGH AUGUST 1969. THE INDEX WAS PREPARED WITH THE AID OF A COMPUTER AND IS PRESENTED IN THE FORM OF COMPUTER PRINTOUT.

BIBLIOGRAPHIES + LITERATURE SURVEYS + OSW SPONSORED

30-01085 JOHNSSON KO

ABSTRACTS OF LITERATURE ON THE DISTILLATION OF SEAWATER AND ON THE USE OF NUCLEAR ENERGY FOR
DESALTING - 1

OAK RIDGE NATIONAL LABORATORY, TENN.

ORNL-TM-2691 (NOV.1969), 216 P

ABSTRACTS ARE GIVEN FOR APPROXIMATELY 900 PUBLISHED ARTICLES RELATED TO THE DESALINATION OF SEAWATER. THE BODY OF THE REPORT IS A COPY OF INFORMATION STORED IN A COMPUTERIZED STORAGE AND RETRIEVAL SYSTEM ON DESALINATION AT THE OAK RIDGE NATIONAL LABORATORY. THE ABSTRACTS ARE GROUPED IN NINE CATEGORIES. AUTHOR AND KEYWORD INDEXES TO THE ARTICLES REFERENCED ARE PROVIDED. THE KEYWORDS, WHICH IDENTIFY THE CONTENT OF THE ARTICLES, WERE CHOSEN FROM A THESAURUS DEVELOPED AT ORNL.

*BIBLIOGRAPHIES + AEC SPONSORED + OSW SPONSORED

30-01086 HICKMAN K + MAA JR + HARRIS PF + DAVIDHAZY A

BEHAVIOR OF LIQUID SURFACES DURING EVAPORATION AND CONDENSATION
ROCHESTER INSTITUTE OF TECHNOLOGY, NEW YORK

OSW R+D PROGR. REPT. NO.392 (NOV.1969), 80 P, 56 FIG, 3 TABLES, 34 REF

THREE EXPERIMENTAL TECHNIQUES FOR INVESTIGATING THE TRANSPORT PROPERTIES OF LIQUID SURFACES ARE DESCRIBED. THE JET TENSIMETER, A DEVICE FOR MEASURING THE CONDENSATION AND EVAPORATION COEFFICIENTS OF LIQUIDS, CONSISTS OF A RECIRCULATING LOOP CONTAINING A FREE JET REGION IN WHICH THE RECIRCULATING LIQUID IS EXPOSED FOR VERY SHORT INTERVALS TO ITS OWN VAPOR AT EITHER HIGHER OR LOWER TEMPERATURES. THE CONTINUOUS BOULE MAKER IS A DEVICE FOR PRODUCING BOULES (DROPS OF A FLUID SUSPENDED BY A THIN LAYER OF ITS OWN SUPERHEATED VAPOR ABOVE A POOL OF THE SAME FLUID). THE BOULE MAKERS ARE USED TO STUDY THE SURFACE STRUCTURE OF PURE WATER AND OF WATERS CONTAINING TRACE IMPURITIES AND ALSO TO PREPARE PURE WATER BY CONTINUOUS BOULE PRODUCTION AND REMOVAL. A MODIFIED SCHLIEREN PHOTOGRAPHIC TECHNIQUE WAS USED TO OBSERVE THE MOVEMENTS OF LIQUID SURFACES EVAPORATING INTO THEIR OWN VAPORS. THE RESULTS OBTAINED SO FAR IN REFINING THE TECHNIQUES AND IN APPLYING THEM TO THE STUDY OF THE PROPERTIES OF PURE WATER INTERFACES ARE PRESENTED AS TABLES, GRAPHS AND PHOTOGRAPHS.

*CONDENSING + *EVAPORATOR DYNAMICS + CONDENSATION PROMOTERS + CONDENSERS + DISTILLATION PROCESSES + EVAPORATORS + FILM BOILING + HEAT TRANSFER + OSW SPONSORED + SURFACE BOILING + THERMAL PROPERTIES + THERMODYNAMICS

30-01092 LEGAULT RA

SEA WATER CORROSION CONTROL BY ENVIRONMENT MODIFICATION
DOW CHEMICAL CO., FREEPORT, TEX.

OSW R+D PROGR. REPT. NO.438 (APR.1969), 115 P, 49 FIG, 29 TABLES, 26 REF

CORROSION TESTS IN HOT (250 DEG F) SEAWATER INDICATE (1) 5052 ALUMINUM CAN BE USED. DISSOLVED OXYGEN IS NOT DETRIMENTAL, (2) MILD STEEL CAN BE USED PROVIDED OXYGEN IS EXCLUDED, (3) MILD STEEL CAN BE USED IN PRESENCE OF OXYGEN IF 50 PPM OF A BINARY PHOSPHATE-CHROMATE INHIBITOR IS ADDED, (4) 1100 ALUMINUM CAN BE USED WITH PH CONTROL AND 50 PPM OF BICARBONATE ION ADDED TO THE SEAWATER, (5) 1100, 3003, 5554 AND 6061 ALUMINUM CAN BE USED WITH 100 PPM OF CHROMATE ION ADDED TO THE SEAWATER. DISSOLVED OXYGEN DOES NOT NOTICEABLY AFFECT THE CORROSION OF ALUMINUM. THE CORROSION OF ALUMINUM (PITTING) IS SENSITIVE TO THE PH OF THE SEAWATER. ALL TESTS WERE GALVANICALLY ISOLATED. FURTHER STUDIES FOR LONGER TIME PERIODS UNDER DYNAMIC CONDITIONS OF DESALINATION CONDITIONS ARE RECOMMENDED.

*ALUMINUM ALLOYS + *CORROSION CONTROL + CARBON STEELS + CHEMICAL ADDITIVES + CHEMICAL CORROSION CONTROL + CORROSION + CORROSION TESTS + DEAERATION + EXPERIMENTAL DATA +

ACCESSION NUMBER 30-01082 TO 30-01092

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01092 *CONTINUED*

FABRICATION MATERIALS + HUMIDIFICATION PROCESSES + IMMERSION TESTS (CORROSION) + OSW SPONSORED + OXIDATION + PH CONTROL

30-01105 KOHL AL + SHIMAZAKI TT + WETCH JR + BIENVENUE LL

DEVELOPMENT OF DIRECT CONTACT CONDENSATION MULTISTAGE FLASH (DCC-MSF) DISTILLATION PROCESS - PHASE I - FINAL REPORT

ATOMICS INTERNATIONAL, CANOGA PARK, CALIF.

OSW R+D PROGR. REPT. NO.475 (SEPT.1969), 110 P, 37 FIG, 14 REF. ALSO AI 69-53.

THE FEASIBILITY OF THE ATOMICS INTERNATIONAL DIRECT CONTACT CONDENSATION MULTISTAGE FLASH (DCC-MSF) DISTILLATION PROCESS WAS INVESTIGATED BY THE CONDUCT OF ANALYTICAL AND EXPERIMENTAL STUDIES ON A DIRECT CONTACT CONDENSATION MODULE AND A PLASTIC FILM HEAT EXCHANGER. THE STUDIES INDICATED THE PROCESS TO BE FEASIBLE. DIRECT CONTACT CONDENSATION OF STEAM ONTO THE SURFACE OF WATER FLOWING IN OPEN CHANNELS WAS ACCOMPLISHED WITH HEAT TRANSFER COEFFICIENTS GREATER THAN 2000 BTU/HR SQ FT (1) BY PROVIDING A HIGH CROSS FLOW STEAM VELOCITY TO DISTURB THE WATER SURFACE, AND (2) BY THE USE OF SIMPLE VANE TYPE TURBULENCE PROMOTERS IN THE WATER SYSTEM. LONG TERM STRENGTH, CREEP RATE, AND RESISTANCE TO HOT BRINE OF PVF FILMS WERE FOUND TO BE ADEQUATE FOR ITS USE IN PLASTIC FILM HEAT EXCHANGERS. A PLASTIC FILM HEAT EXCHANGER WAS DESIGNED, FABRICATED, TESTED, AND OPERATED. NO OPERATIONAL PROBLEMS WERE ENCOUNTERED. A TECHNIQUE WAS DEvised FOR FABRICATING LAP WELDED, PLASTIC FILM TUBES.

*CONDENSING + *DIRECT CONTACT HEAT EXCHANGE + *HEAT EXCHANGERS + *SYNTHETIC RESINS (PLASTICS) + MULTISTAGE FLASH DISTILLATION + OSW SPONSORED + TURBULENCE PROMOTERS

30-01108 FABUSS BM + BORSANYI AS + LU CH

INVESTIGATION OF CALCIUM SULFATE PRECIPITATION

MONSANTO RESEARCH CORP., EVERETT, MASS.

OSW R+D PROGR. REPT. NO.183 (MAY 1966), 40 P, 17 FIGS, 8 TABLES, 3 REF

AN INVESTIGATION OF THE PRECIPITATION OF CALCIUM SULFATE FROM DISTILLED WATER BY CONSTANT VOLUME HEATING AND CONSTANT TEMPERATURE EVAPORATION. THE CONCENTRATION OF CALCIUM SULFATE WAS FOLLOWED BY CONDUCTIVITY AND TITRATION. BREAK POINTS, IN THE CONDUCTIVITY, WERE OBSERVED NEAR THE DIHYDRATE AND HEMIHYDRATE SOLUBILITY CURVES, AT OR BELOW 100 DEG C, SHIFTING TOWARD THE ANHYDRITE CURVE AS THE TEMPERATURE INCREASED, IN THE CONSTANT VOLUME HEATING EXPERIMENTS. IN THE CONSTANT TEMPERATURE EVAPORATION TESTS THE BREAK POINTS WERE SLIGHTLY ABOVE THE ANHYDRITE CURVE. PRECIPITATION OCCURRED AFTER THE BREAK POINT. PRECIPITATION WITH RESPECT TO ANHYDRITE WAS SLOW, AND SUBSTANTIAL PRECIPITATION OCCURRED ONLY WHEN THE HEMIHYDRATE CURVE WAS APPROACHED. INITIAL PRECIPITATION OCCURRED CLOSER TO THE ANHYDRITE CURVE AS THE TEMPERATURE INCREASED.

*PHYSICAL CHEMISTRY OF SCALE + FEEDWATER TREATMENT + OSW SPONSORED + SCALE PREVENTION + SCALING

30-01109 SCALE CONTROL FOR SALINE WATER CONVERSION DISTILLATION PLANTS

BALDWIN-LIMA-HAMILTON CORP., PHILADELPHIA

OSW R+D PROGR. REPT. NO.186 (APR.1966), 18 P, 23 FIG, 11 TABLES

TESTS WERE PERFORMED TO EVALUATE SIX SCALE CONTROL METHODS. FIVE WERE USED WITH A SIX-STAGE FLASH PLANT - (1) PROPRIETARY ANTI-SCALING COMPOUNDS, (2) CALCIUM CARBONATE SLUDGE RECIRCULATION (3) CALCIUM SULFATE SLUDGE RECIRCULATION, (4) SULFURIC ACID WITH CALCIUM SULFATE SLUDGE RECIRCULATION, AND (5) PH CONTROL. THE SIXTH METHOD, PH CONTROL WITH HOT-END CALCIUM SULFATE SLUDGE ADDITION, WAS TESTED IN A LONG TUBE VERTICAL EVAPORATOR. METHOD (1) RESULTED IN SOFT DEPOSITS ON HEAT EXCHANGE SURFACES (2) 1.5 - 2.0 WEIGHT PERCENT CALCIUM CARBONATE AT SIX FEET PER SECOND VELOCITY PREVENTED LOSS IN HEAT TRANSFER UP TO 285 DEG F (3) NOT SUCCESSFUL (4) NOT SUCCESSFUL (5) LONG TERM OPERATION WITHOUT SCALE (6) OPERATED SUCCESSFULLY.

*FEEDWATER TREATMENT + *SCALE PREVENTION + CHEMICAL ADDITIVES + MULTISTAGE FLASH DISTILLATION + OSW SPONSORED + SEEDING PROCESSES + VERTICAL TUBE EVAPORATORS

30-01110 AN INVESTIGATION OF THE SOLUBILITY OF CALCIUM SULFATE IN SEAWATER CONCENTRATES AT TEMPERATURES FROM AMBIENT TO 65 DEGREES C

AMERICAN MACHINE AND FOUNDRY CO., SPRINGDALE, CONN.

OSW R+D PROGR. REPT. NO.191 (MAY 1966), 77 P, 14 FIG, 6 TABLES, 12 REF

AN INVESTIGATION OF THE CRYSTALLIZATION OF SOLIDS FROM CONCENTRATED SEAWATER BRINES. CONCLUSIONS WERE (1) CALCIUM SULFATE DIHYDRATE PRECIPITATES AS DECARBONATED SEAWATER IS EVAPORATED AT 35-60 DEG C, (2) THE MOLAL SOLUBILITY PRODUCT OF DIHYDRATE IS 0.00151 AT 20 DEG C, 0.00164 AT 40 C, AND 0.00156 AT 60 C, (3) THE SOLUBILITY PRODUCT OF DIHYDRATE AT 40 DEG C IS 0.00164 IN NORMAL SEAWATER, 0.00342 IN 3X SEAWATER AND 0.00385 IN 6X SEAWATER, (4) IN 6X SEAWATER THE SOLUBILITY PRODUCT INCREASES WITH TEMPERATURE FROM 0.00358 AT 20 DEG C TO 0.00385 AT 40 DEG C AND TO 0.00441 AT 60 DEG C.

*PHYSICAL CHEMISTRY OF SCALE + FEEDWATER TREATMENT + OSW SPONSORED + SCALE PREVENTION + SCALING

30-01111 DEVELOPMENT OF PRECIPITATION PROCESSES FOR REMOVAL OF SCALE FORMERS FROM SEAWATER

W. R. GRACE AND CO., CLARKSVILLE, MD.

OSW R+D PROGR. REPT. NO.192 (MAY 1966), 467 P, 148 TABLES, 94 FIG, 23 REF

SEAWATER SOFTENING PROCESSES EMBODYING THE REMOVAL OF SCALE FORMERS BY PRECIPITATION WITH PHOSPHATE-AMMONIA AND WITH LIME-MAGNESIUM-CARBONATE ARE DETAILED. EXPERIMENTAL WORK, BOTH LABORATORY AND PILOT PLANT SCALE, IS DISCUSSED. APPRAISALS OF BOTH PROCESSES, BOTH ECONOMIC AND OPERATIONAL ARE MADE. CAPITAL AND OPERATING COST ESTIMATES ARE PRESENTED. THE ECONOMICS OF THE PHOSPHATE-AMMONIA PROCESS REQUIRE SALE OF A HIGH QUALITY BY-PRODUCT FERTILIZER AT A 10 TO 20% PREMIUM. IN ADDITION ABOUT 200 PPM OF AMMONIA REMAIN IN THE PRODUCT WATER. THE LMC PROCESS HAD A PROJECTED OPERATING COST OF 9.9 CENTS/1000 GAL OF FRESH WATER WITH FURTHER DEVELOPMENT THE PROJECTED COST DROPPED TO 7.0 CENTS/1000 GAL.

*FEEDWATER TREATMENT + *PRECIPITATION + *REMOVAL FROM FEEDWATER, CALCIUM + *SCALE PREVENTION + BY-PRODUCT ECONOMICS + CAPITALIZED COSTS + CHEMICAL BY-PRODUCTS + ECONOMIC EVALUATIONS + FEASIBILITY STUDY + FERTILIZER + OPERATING COSTS + OSW SPONSORED

ACCESSION NUMBER 30-01092 TO 30-01111

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01112 RESEARCH AND DEVELOPMENT ON THE HORIZONTAL SPRAY FILM EVAPORATOR

AQUA-CHEM, INC., WAUKESHA, WIS.

OSW R+D PROGR. REPT. NO.209 (NOV.1966), 81 P, 28 FIG, 4 TABLES, 9 REF

FRESH WATER AND SEAWATER HEAT TRANSFER EXPERIMENTS WERE CONDUCTED USING A HORIZONTAL SPRAY FILM EVAPORATOR. HEAT TRANSFER COEFFICIENTS OF 1125 BTU/HR-DEG-F-SQ FT WERE OBTAINED WITH COPPER-NICKEL TUBES, 5/8 IN. DIAM, AND 2400 BTU/HR-DEG-F-SQ FT WITH COPPER TUBES 1.5 IN. DIAM. THE COEFFICIENT WAS INDEPENDENT OF TUBE DIAMETER. DROPTWISE CONDENSATION PROMOTION USING MONTAN WAX INCREASED THE COEFFICIENT BY 20%. THE EVAPORATOR WAS FOUND SUITABLE FOR MULTISTAGE OPERATION AT SHELL TEMPERATURE LEVELS FROM 230 TO 80 DEG F. A THEORETICAL ANALYSIS OF THE VARIOUS OPERATING PARAMETERS IS PRESENTED.

*FILM EVAPORATION + *HEAT EXCHANGERS + CONDENSATION PROMOTERS + HEAT TRANSFER COEFFICIENT + HORIZONTAL TUBE EVAPORATORS + OSW SPONSORED + VAPOR COMPRESSION EVAPORATION

30-01113 STEEL GN

RESEARCH ON CONDENSATION MECHANISMS

SIGMATRON INC.

OSW R+D PROGR. REPT. NO.215 (OCT.1966), 37 P, 8 FIG, 1 TABLE, 17 REF

AN APPARATUS WAS BUILT TO DETERMINE THE DWELL TIME OF ATOMS OF BISMUTH ADSORBED FROM A TEMPERATURE AND DENSITY CONTROLLED VAPOR BEAM, ON A TEMPERATURE CONTROLLED COPPER SURFACE. NO EXPERIMENTAL DATA IS PRESENTED DUE TO DIFFICULTIES WITH THE HIGH VACUUM APPARATUS. THE APPARATUS IS DESCRIBED AND RECOMMENDATION FOR CORRECTIVE ACTION REQUIRED FOR THE CONTINUATION OF THE EXPERIMENTS ARE GIVEN. BACKGROUND INFORMATION AND STUDIES ASSOCIATED WITH CONDENSATION MECHANISMS ARE REVIEWED AND EXTENDED.

*CONDENSING + CONDENSERS + HEAT TRANSFER + OSW SPONSORED

30-01114 DEWINTER F + SADEK SE + REYNOLDS JM

PARAMETRIC COST STUDIES OF THE MULTISTAGE FLASH PROCESS

DYNATECH CORP., CAMBRIDGE, MASS.

OSW R+D PROGR. REPT. NO.251 (MAR.1967), 151 P, 62 FIG, 11 TABLES, 18 REF

A STUDY OF THE EFFECTS OF VARYING THE STEAM, TUBING, SHELL, PUMP AND POWER, AND WATER TREATMENT AND SUPPLY COSTS ON A MSF PLANT DESIGN. LABOR AND FIXED CAPITAL COSTS, OTHER THAN THE ABOVE, WERE ESTIMATED AS 10 AND 6.5 CENTS/1000 GAL RESPECTIVELY AND WERE ASSUMED INVARIANT WITH PLANT DESIGN. THE OPTIMIZATION CONSISTED OF CALCULATING WATER COST FOR A GIVEN SET OF INPUT COST DATA WHILE VARYING THE PLANT PARAMETERS UNTIL A MINIMUM WATER COST WAS OBTAINED. FOR CONVENIENCE, THE EFFECT OF VARIATIONS IN PAIRS OF THE UNIT COSTS, WHILE HOLDING THE OTHER THREE CONSTANT, WAS INVESTIGATED RATHER THAN ALLOWING ALL FIVE TO VARY INDEPENDENTLY. THE COMPUTER PROGRAM USED IS LISTED.

*COST BREAKDOWNS + *PARAMETRIC STUDIES + *PROGRAMS (COMPUTERS) + CONSTRUCTION COSTS + ECONOMIC EVALUATIONS + ENERGY COSTS + FIXED COSTS + MATHEMATICAL MODELS + MULTISTAGE FLASH DISTILLATION + OPERATING COSTS + OSW SPONSORED

30-01115 FIFTH ANNUAL REPORT, SALINE WATER CONVERSION DEMONSTRATION PLANT NO. 1, FREEPORT, TEXAS

STEARNS-ROGER MANUFACTURING CO., DENVER

OSW R+D PROGR. REPT. NO.253 (MAR.1967), 274 P, 38 TABLES, 68 FIG, 6 REF

DATA DERIVED FROM THE RESULTS OF OPERATION, MAINTENANCE, AND DEVELOPMENT STUDIES ON THE LTV MULTIPLE EFFECT EVAPORATION DESALINATION PLANT ARE PRESENTED FOR FY-1966. EVALUATION OF THE PROCESS, EQUIPMENT, CORROSION, MATERIAL OF CONSTRUCTION, ACTUAL CAPITAL AND OPERATING COSTS, PRODUCTION, ECONOMY RATIOS, COST AVERAGES AND MAINTENANCE PROBLEMS ARE INCLUDED. EVALUATION OF ADVANCED DESIGN EQUIPMENT AND HIGH ACCURACY INSTRUMENTATION IS MADE. FINDINGS PERTINENT TO THE DECISION FOR INCREASING THE TRAIN TO 17 EFFECTS ARE INCLUDED.

*FREEPORT PLANT + *OPERATING EXPERIENCE + COST BREAKDOWNS + ECONOMIC EVALUATIONS + INSTRUMENTATION + MAINTENANCE + OSW SPONSORED + VERTICAL TUBE EVAPORATORS

30-01116 ENNIS E + GELBLUM GP + PECHENICK W

EVALUATION OF BRINE DESULFATING PROCESS AS APPLIED TO DESALINATION, PHASE 1

CATALYTIC CONSTRUCTION CO., PHILADELPHIA

OSW R+D PROGR. REPT. NO.289 (OCT.1967), 42 P, 9 FIG, 8 TABLES, 5 REF

A STUDY WAS MADE OF THE FEASIBILITY OF APPLYING THE BUREAU OF MINES SULFATE REMOVAL PROCESS TO THE DESULFATING OF FEED SEAWATER. THE PROCESS CONSISTS OF PRECIPITATING THE SULFATE IN SEAWATER WITH AN ION EXCHANGE RESIN IN THE BARIUM FORM. THE BARIUM SULFATE IS RECOVERED, ROASTED WITH CARBON, AND LEACHED. THE LEACHANT IS USED TO REFORM THE RESIN. BY-PRODUCT SODIUM SULFIDES AND HYDROXIDES ARE RECOVERED AND SOLD AFTER CONVERSION TO SODA ASH, CAUSTIC SODA, AND SULFURIC ACID. AN ECONOMIC ANALYSIS OF THE PROCESS AS APPLIED TO A 50 MGD DESALTING PLANT INDICATES THAT THE DESULFATING PROCESS, WHEN INTEGRATED WITH THE DESALTING PLANT, WILL REDUCE OR EVEN ELIMINATE THE COST OF CONVERTING SEAWATER TO FRESH WATER.

*BY-PRODUCT MANUFACTURING PROCESSES + *ECONOMIC EVALUATIONS + *FEEDWATER TREATMENT + CHEMICAL BY-PRODUCTS + CHEMICAL PRODUCTION + ION EXCHANGING + OSW SPONSORED + REMOVAL FROM FEEDWATER, SULFATE + SCALE PREVENTION

30-01117 DEVELOPMENT REPORT NO. 5 - SALINE WATER CONVERSION DEMONSTRATION PLANT NO. 1, FREEPORT, TEXAS

STEARNS-ROGER CORP., DENVER

OSW R+D PROGR. REPT. NO.297 (SEPT.1967), 49 P, 15 TABLES, 5 FIG

THE RESULTS OF DEVELOPMENT RUN NOS. 6 AND 7. RUN 6 CONFIRMED THAT PLANT PRODUCTIVITY WAS LIMITED BY PUMPING CAPACITY. RUN 7 SHOWED SCALE FREE OPERATION AT 280 DEG F (HEATING STEAM TEMPERATURE) USING 30% LESS EVAPORATOR SURFACE. AT THIS LEVEL, THE PLANTS POTENTIAL PRODUCTIVITY IS 1.52 MGD WITH A COST OF 90.8 CENTS/1000 GAL. THE ANHYDRITE SCALING LIMIT IN CLEAN FIRST-EFFECT TUBES WITH 3.52% TDS FEED WAS BETWEEN 292 AND 282 DEG F. AFTER INITIAL SCALING THE LIMIT IS LESS THAN 275 DEG F. ANHYDRITE SCALE REMOVAL WAS DIFFICULT. POLYPHOSPHATE PREVENTED GYPSUM SCALE DEPOSITION UP TO A BLOWDOWN CONCENTRATION OF 3.06 TIMES NORMAL SEAWATER.

ACCESSION NUMBER 30-01112 TO 30-01117

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01117 *CONTINUED*

*FREEPORT PLANT + *PILOT PLANT OPERATIONS + HEAT TRANSFER + OPERATING COSTS + OPERATING EXPERIENCE + OPERATIONAL PROBLEMS + OSW SPONSORED + SCALE REMOVAL + SCALING

30-01119 LU CH + FABUSS BM + KOROSI A + MIDDLETON TR + DEMONICO JP

BASIC STUDIES OF SCALE CONTROL
MONSANTO RESEARCH CORP., EVERETT, MASS.

OSW R+D PROGR. REPT. NO.461 (MAR.1969), 52 P, 15 TABLES, 17 FIG, 11 REF

(1) THE SOLUBILITY OF CALCIUM SULFATE ANHYDRITE IN ROSWELL WATER WAS DETERMINED OVER THE TEMPERATURE RANGE OF 76 TO 235 DEG F AT CONCENTRATION FACTORS FROM 1 TO 4. THE KINETIC DATA AND THE DISSOLUTION AND PRECIPITATION OF CALCIUM SULFATE WERE CORRELATED BY RATE EQUATIONS FOR USE IN SCALE CONTROL. INDICATIONS WERE THAT SATURATION WAS ATTAINED WITHIN ONE HALF HOUR. (2) LABORATORY TESTS WERE CONDUCTED ON THE SLURRY SEEDING PROCESS FOR CONTROL OF CALCIUM SULFATE SCALE. THE MAIN RESULTS WERE (A) CRYSTAL GROWTH WAS SLOW (B) OPERATING CONDITIONS WERE NOT AT EQUILIBRIUM (C) TOTAL PRECIPITATION INCREASED WITH HEATER WALL TEMPERATURE AND SEAWATER QUANTITY (D) PRESENCE OF SEEDS IN A FLUIDIZED BED HEATER IMPROVED THE HEAT TRANSFER COEFFICIENT AND REDUCED SCALING.

*PHYSICAL CHEMISTRY OF SCALE + *SCALE PREVENTION + *SEEDING PROCESSES + FEEDWATER TREATMENT + OSW SPONSORED + ROSWELL PLANT + SCALING

30-01124 ELLIOT MN

THE PRESENT STATE OF SCALE CONTROL IN SEA WATER EVAPORATORS

ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL, ENGLAND

AERE-R-5820 (SEPT.1968), 21 P, 1 TABLE, 7 FIG, 50 REF. ALSO PRESENTED AT EUROP. FED. INST. CHEM. ENGR., FLUSHING, MAY 1968

THE CONTROL OF SCALE IS IMPORTANT TO THE FURTHER DEVELOPMENT OF EVAPORATORS FOR THE DESALINATION OF SEAWATER. THE METHODS OF SCALE CONTROL USED AT PRESENT ARE DISCUSSED, TOGETHER WITH ALTERNATIVES WHICH ARE UNDER STUDY OR HAVE BEEN PROPOSED. ASSUMING THAT IMPROVED ADDITIVES CAN BE DEVELOPED, THE ADDITIVE TREATMENT IS MORE ATTRACTIVE THAN ALTERNATIVE METHODS SUCH AS ION EXCHANGE OR PRECIPITATION WHICH SIGNIFICANTLY INCREASE THE CAPITAL COST OF THE EVAPORATOR.

*FEEDWATER TREATMENT + *REVIEWS + *SCALE PREVENTION + ACID STABILIZATION PROCESSES + CHEMICAL ADDITIVES + DISTILLATION PROCESSES + ION EXCHANGING + PH ADJUSTMENT + PRECIPITATION + SCALING + SEEDING PROCESSES

30-01127 ELLIS RD

SCALE ABATEMENT IN SALINE WATER DISTILLATION BY INJECTION OF CARBON DIOXIDE

ENGINEERING DEPT., UNIV. CALIF., LOS ANGELES

REPT. 69-61, UCLA ENG. DEPT. (OCT.1969), 113 P, 7 TABLES, 21 FIG, 39 REF. (SUMMARY IS GIVEN IN REPT. 70-1)

M.S. THESIS. TO DETERMINE THE EFFECT OF CARBON DIOXIDE ON THE RATE OF SCALE DEPOSITION, A SMALL-SIZED HEATING LOOP WAS CONSTRUCTED. OVER AN OUTLET WATER TEMPERATURE RANGE FROM 187 TO 287 DEG F, IT WAS POSSIBLE TO FORM MAGNESIUM HYDROXIDE SCALE IN THE LOOP AFTER ONLY ONE HOUR OF OPERATION. INJECTION OF CARBON DIOXIDE INTO THE FEED SEAWATER RESULTED IN THE FORMATION OF CARBONIC ACID, CAUSING AN IMMEDIATE DEPRESSION IN PH. PRODUCTION OF HYDROGEN ION WAS APPROX. LINEARLY RELATED TO THE ADDITION CONCENTRATION. CARBON DIOXIDE ADDED AT RATES FROM 10 TO 20 PPM WAS SUFFICIENT TO CAUSE A DRASTIC REDUCTION IN THE RATE OF SCALE GROWTH. ALKALINE SCALE WAS COMPLETELY AVOIDED UP TO A TEMPERATURE OF 285 DEG F BY MAINTAINING THE FEED PH BELOW 6.4 WITH THE INJECTION OF 64 PPM CARBON DIOXIDE. IN A SINGLE FLASH CHAMBER PROVIDED AFTER THE HEAT EXCHANGER, BOTH THE CARBON DIOXIDE ADDED AND A FRACTION OF THAT LIBERATED FROM BICARBONATE BREAKDOWN WERE RAPIDLY EVOLVED.

*CARBON DIOXIDE ADDITION PROCESS + *SCALE PREVENTION + DISTILLATION PROCESSES + FEEDWATER TREATMENT + PH CONTROL + PHYSICAL CHEMISTRY OF SCALE + SCALE REMOVAL + SCALING

30-01140 MULTISTAGE FLASH DISTILLATION DESALTING STATE-OF-THE-ART (1968)

HITTMAN ASSOCIATES, INC., COLUMBIA, MARYLAND

OSW R+D PROGR. REPT. NO.490 (OCT.1969), 138 P, 24 TABLES, 40 FIG, 48 REF

AN EVALUATION OF DUAL- AND SINGLE-PURPOSE PLANTS OVER THE RANGE FROM 1 TO 150 MGD. THE REPORT WAS PREPARED BY REVIEWING DATA ON ACTUAL PLANTS AND CONCEPTUAL DESIGN STUDIES. ADDITIONAL INFORMATION WAS OBTAINED THROUGH DISCUSSION WITH PERSONNEL FROM OSW AND DESALTING PLANT AND EQUIPMENT MANUFACTURERS. THIS REPORT PRESENTS THE SALIENT ASPECTS OF PROCESS AND EQUIPMENT DESIGN OF MSF EVAPORATORS. ALSO MANY OF THE DEVELOPMENTAL AREAS FOR FUTURE LARGE (50 MGD AND GREATER) PLANTS HAVE BEEN EXAMINED AND ANALYZED. A MAJOR PORTION OF THE REPORT IS CONCERNED WITH CAPITAL COSTS AND OPERATING COSTS. MULTISTAGE FLASH EVAPORATION PLANTS CAN CURRENTLY BE BUILT WITH PERFORMANCE RATIOS IN EXCESS OF 14. HOWEVER, STEAM ECONOMY, WHICH IS RELATED TO REDUCED OPERATING COSTS, IS COUNTERACTED BY INCREASES IN THE PLANT CAPITAL COST. FOR MOST CURRENT APPLICATIONS, PLANT PERFORMANCE RATIOS OF ABOUT 9-11 POUNDS PER 1000 BTU RESULT IN MINIMUM WATER COST. THE EVAPORATOR TUBE BUNDLES AND SHELL COMPRISE THE MAJOR PORTION (APPROXIMATELY 40-60%) OF THE INSTALLED PLANT CAPITAL COST. CURRENTLY 0.75 INCH 90-10 CUNI TUBES AND STEEL SHELLS ARE BEING SPECIFIED IN MOST MSF PLANT APPLICATIONS. TECHNOLOGY EMPLOYED IN THE MSF PROCESS IS RELATIVELY MATURE WHEN COMPARED TO OTHER DESALTING PROCESSES. MOST OF THE FUTURE REDUCTIONS IN WATER COST FROM THIS PROCESS WILL COME FROM IMPROVEMENTS IN MATERIAL AND PROCESS DESIGN AS A RESULT OF INCREASED OPERATING AND DESIGN EXPERIENCE.

*ECONOMIC EVALUATIONS + *MULTISTAGE FLASH DISTILLATION + *REVIEWS + COMPONENT COSTS + COST BREAKDOWNS + DISTILLATION PROCESSES + DUAL-PURPOSE PLANT + OSW SPONSORED + PERFORMANCE RATIO + SINGLE-PURPOSE PLANT + WATER COSTS ESTIMATE + 0-50 MGD PLANT + 51-250 MGD PLANT

30-01141 BROUGHTON DB

MULTIPLE EFFECT EVAPORATION PROCESS

UNIVERSAL OIL PRODUCTS CO., DES PLAINES, ILL.

ACCESSION NUMBER 30-01117 TO 30-01141

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01141 *CONTINUED*

U.S. PAT. 3,306,456 (6-27-63/2-21-67), 1 FIG, 14 REF

A MULTIEFFECT EVAPORATION PROCESS CONSISTING OF DIRECTLY CONTACTING THE SEAWATER FEED IN THE FIRST EVAPORATION ZONE WITH THE VAPORS OF A HYDROCARBON HAVING A BOILING POINT ABOVE THAT OF THE SEAWATER. THE WATER VAPOR FORMED IS CONDENSED IN A FIRST STAGE CONDENSATION ZONE BY DIRECT CONTACT WITH RELATIVELY COOL HYDROCARBON LIQUID WHICH WAS SEPARATED FROM THE MIXTURE OF BRINE AND ORGANIC RECOVERED FROM THE NEXT DOWNSTREAM SECOND STAGE EVAPORATION ZONE.

*DIRECT CONTACT HEAT EXCHANGE + *MULTIPLE EFFECT DISTILLATION + DISTILLATION PROCESSES + FLOWSHEETS + HEAT TRANSFER + PATENTS + SCALE PREVENTION + SYSTEM DESCRIPTIONS

30-01142 PCWELL WW, JR.

DESALINIZATION OF WATER

U.S. PAT. 3,294,649 (8-20-63/12-27-66), 1 FIG, 5 REF

A BODY OF SALINE SOLUTION IS MAINTAINED AT ITS EVAPORATION TEMPERATURE IN CONTACT WITH AND SUPERIMPOSED UPON A BODY OF LIQUID HEAT TRANSFER MEDIUM WHICH IS INSOLUBLE IN THE SALINE SOLUTION BUT WHICH IS MAINTAINED AT AND CAPABLE OF VOLATILIZING AT THE EVAPORATION TEMPERATURE. SEVERAL HALOGENATED ORGANIC COMPOUNDS SUCH AS P-DICHLOROBENZENE AND PERCHLOROETHYLENE ARE SUITABLE HEAT EXCHANGE MEDIA. THE VAPORS OF THE WATER AND HEAT TRANSFER MEDIUM RISE INTO THE EVAPORATION ZONE AND ARE THEN REMOVED AND COMPRESSED, BUT NOT LIQUIFIED, TO AN EXTENT CORRESPONDING TO A CONDENSING TEMPERATURE DIFFERENCE OF ABOUT 10 DEG F ABOVE THE BOILING TEMPERATURE OF THE SALINE SOLUTION. THE COMPRESSED MIXED VAPORS ARE THEN SUBJECTED TO INDIRECT HEAT EXCHANGE WITH THE BODY OF LIQUID HEAT TRANSFER MEDIUM IN THE EVAPORATION ZONE TO CONDENSE LIQUID WATER AND LIQUID HEAT TRANSFER MEDIUM. SINCE THE LATTER TWO LIQUIDS ARE IMMISIBLE, THEY CAN BE EASILY SEPARATED - THE WATER AS PRODUCT AND THE HEAT TRANSFER MEDIUM RETURNED TO THE MAIN BODY OF SALINE WATER IN THE EVAPORATION ZONE.

*DIRECT CONTACT HEAT EXCHANGE + DISTILLATION PROCESSES + HEAT TRANSFER + PATENTS + SYSTEM DESCRIPTIONS + VAPOR COMPRESSION EVAPORATION

30-01147 THOMAS DG + HAYES PH

HIGH-PERFORMANCE HEAT TRANSFER SURFACES

OAK RIDGE NATIONAL LABORATORY, TENN.

IND. ENG. CHEM. 62(2), 4-9 (1970), 5 FIG, 38 REF

THE OVERALL HEAT TRANSFER COEFFICIENT BETWEEN CONDENSING STEAM AND WATER FLOWING IN A VERTICAL ALUMINUM TUBE WAS INCREASED TO VALUES 2.5 TO 4 TIMES THE VALUE FOR SMOOTH TUBES BY COMBINING RECTANGULAR FINS ON THE CONDENSING SIDE AND TWISTED TAPE INSERT ON THE FLOWING WATER SIDE. THE HEAT TRANSFER COEFFICIENT INCREASED WITH INCREASING WATER VELOCITY AND DECREASING HEAT FLUX. THE MAXIMUM HEAT TRANSFER COEFFICIENT WAS 5400 BTU/HR SQ FT DEG F (COMPARED WITH 1300 FOR THE SMOOTH TUBE) WHEN THE WATER VELOCITY WAS 20 FT/SEC AND THE HEAT FLUX WAS 20,000 BTU/HR SQ FT. THE OVERALL HEAT TRANSFER COEFFICIENT BETWEEN CONDENSING STEAM AND A THIN FILM OF EVAPORATING WATER WAS INCREASED TO VALUES 3 TO 10 TIMES THE VALUE FOR SMOOTH TUBES BY COMBINING RECTANGULAR FINS ON BOTH THE EVAPORATING AND CONDENSING SIDE. THE PERFORMANCE OF THE DOUBLE FINNED TUBE DECREASED WITH INCREASING HEAT FLUX. THE MAXIMUM VALUE OF THE HEAT TRANSFER COEFFICIENT, 5000 BTU/HR SQ FT DEG F, WAS OBSERVED AT A HEAT FLUX OF 10,000 BTU/HR SQ FT. RESULTS ARE COMPARED WITH DATA FROM THE LITERATURE FOR OTHER HIGH-PERFORMANCE SURFACES TO ILLUSTRATE THE RANGE OF OPTIONS IN SURFACE SHAPE AND THE MAGNITUDE OF POTENTIAL IMPROVEMENTS AVAILABLE TO THE DISTILLATION PLANT DESIGNER.

*COMPONENT DEVELOPMENT + *HEAT TRANSFER IMPROVEMENTS + *HEAT TRANSFER SURFACES + *TWISTED TAPES + AEC SPONSORED + DESIGN + EVAPORATOR SYSTEM DESIGN + EVAPORATOR-CONDENSER TUBES + EVAPORATORS + EXTENDED HEAT TRANSFER SURFACES + FLASH EVAPORATION + HEAT TRANSFER + OSW SPONSORED + VERTICAL TUBE EVAPORATORS

30-01150 POLLIS W

DUAL-PURPOSE NUCLEAR PLANT FOR SEAWATER DESALINATION - FORCED HYGROMETRIC PROCESS

COMISSAO NACICNAL DE ENERGIA NUCLEAR, RIO DE JANEIRO, BRAZIL

PREPRINT OF PAPER SM-126/25 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT. 20-24, 1969

THE FORCED HYGROMETRIC PROCESS CONSISTS OF BAPORIZATION OF SEAWATER IN THE PRESENCE OF HOT AIR. WATER SPRAYERS ARE USED TO FACILITATE THE SATURATION OF THE AIR (100% RELATIVE HUMIDITY) AT ESTABLISHED PRESSURE AND TEMPERATURE CONDITIONS. THE AIR STREAM SATURATED WITH WATER VAPOR IS THEN PUMPED TO THE CONDENSER, WHERE ITS TEMPERATURE IS LOWERED TO THE DEW POINT AND THE EXCESS WATER VAPOR IS DEPOSITED IN THE FRESH WATER CONTAINER. BY MEANS OF A CLOSED AIR CIRCUIT AND OPTIMIZATION OF PRESSURE AND TEMPERATURE CONDITICNS, HIGHER SAVINGS AND LOWER COSTS MAY BE OBTAINED THAN WITH OTHER SYSTEMS. ADVANTAGES OF THE HYGROMETRIC PROCESS OVER THE MULTISTAGE FLASH PROCESS, THE MOST ECONOMICAL PROCESS PRESENTLY IN USE ARE - (1) IT OPERATES AT LOW PRESSURES, A LITTLE ABOVE 1 ATM, (2) NO CORROSION PROBLEMS ARE INVOLVED, AS THE SALT WATER DOES NOT FLOW THROUGH MOST OF THE CIRCUIT COMPONENTS, (3) NO PROBLEM OF SCALING ON EVAPORATOR WALLS IS PRESENTED, AS THE SALT WATER IS AT LOW TEMPERATURE AND NO BOILER IS USED IN THE SYSTEM, (4) PUMPING POWER REQUIREMENTS ARE LOW, AND (5) FRESH WATER COSTS ARE LOW, EVEN WHEN SMALL REACTORS ARE USED.

*DUAL-PURPOSE PLANT + *HUMIDIFICATION PROCESSES + *NUCLEAR ENERGY SOURCES + DUAL-PURPOSE PLANT ECONOMICS + ECONOMIC CONDITIONS + ECONOMIC EVALUATIONS + ENERGY SOURCES + NUCLEAR DESALINATION

30-01158 AHLGREN RM

SELECTION OF MATERIALS FOR DESALINATION PLANTS

AQUA-CHEM, INC., WAUKESHA, WIS.

MATER. PROTECT. 7(10), 31-32 (1968), 14 REF

CAREFUL ATTENTION MUST BE PAID TO THE ACTUAL SEAWATER ANALYSIS OVER A PERIOD OF TIME AT THE SITE OF A DESALINATION FACILITY. SOME OF THE AGENTS WHICH PLAY AN IMPORTANT ROLE IN CORROSION ARE (1) OXYGEN, (2) CARBON DIOXIDE, (3) HYDROGEN SULFIDE, (4) AMMONIA,

ACCESSION NUMBER 30-01141 TO 30-01158

CATEGORY 30 - SEAWATER DISTILLATION PROCESSES

30-01158 *CONTINUED*

(5) CHLORINE, (6) HYDROGEN ION (LOW PH), (7) IRON AND COPPER, (8) SAND, SLUDGE, AND FOREIGN MATTER, AND (9) BACTERIAL AND MARINE GROWTHS. SINCE THE HEAT EXCHANGE TUBING REPRESENTS A LARGE PORTION OF THE PLANT COST, VERY CAREFUL CONSIDERATION OF SUITABLE MATERIALS MUST BE MADE. TUBES AND TUBE-SHEETS ARE GENERALLY MADE OF ADMIRALTY, ALUMINUM BRASS, 90/10 COPPER-NICKEL, OR 70/30 COPPER-NICKEL. PLAIN CARBON STEEL WATER BOXES HAVE BEEN USED IN MANY PLANTS WITH THE PROTECTION OF THE TUBING AT THE EXPENSE OF THE WATER BOX. CARBON STEEL DISTILLATE TROUGHS NORMALLY GIVE GOOD SERVICE AS LONG AS TRACES OF IRON ARE NOT OBJECTIONABLE. MONEL HAS BEEN MOST WIDELY USED FOR THE DEMISTER IN GENERAL PLANT PRACTICE. PIPING WILL GENERALLY BE OF THE SAME CONSTRUCTION AS THE WATERBOXES IN THE SAME AREA. THROUGH THE USE OF BRONZE BODIED PUMPS WITH HIGH ALLOY (NICKEL-COPPER ALLOY 400), SHAFTS AND IMPELLERS, GOOD SERVICE HAS RESULTED. THE 720,000 GPD DISTILLATION PLANT IN ILO, PERU, INSTALLED IN 1966, IS A GOOD EXAMPLE OF WHAT CAREFUL CONSIDERATION AND PLANNING CAN DO TO PREVENT CORROSION.

*CORROSION + *FABRICATION MATERIALS + COPPER ALLOYS + DISTILLATION PROCESSES + PUMPS + REVIEWS

30-01159 SCHREIBER CF + OSBORN O + COLEY FH

CORROSION OF METALS IN DESALINATION ENVIRONMENTS

DOW CHEMICAL CO., FREEPORT, TEX. + OFFICE OF SALINE WATER, WASHINGTON

MATER. PROTECT. 7(10), 20-24 (1968), 9 FIG, 9 REF

THE PRELIMINARY RESULTS OF A LABORATORY INVESTIGATION OF THE CORROSION BY SEAWATER OF FIVE COPPER ALLOYS STUDIED AT THE OSW FREEPORT, TEX., TEST FACILITY. THE ALLOYS TESTED WERE PHOSPHOROUS DEOXIDIZED COPPER (ALLOY 122), IRON-MODIFIED 90/10 COPPER-NICKEL (ALLOY 706), IRON-MODIFIED 70/30 COPPER-NICKEL (ALLOY 715), ALUMINUM BRASS (ALLOY 687), AND ARSENIC-INHIBITED ADMIRALTY (ALLOY 443). AT THIS STAGE OF THE STUDY SEVERAL POINTS MAY BE CONCLUDED (1) DISSOLVED OXYGEN CONCENTRATION HAS PROBABLY THE GREATEST SINGLE AND INTERACTIVE EFFECT ON COPPER ALLOY CORROSION IN HOT SEAWATER, (2) IN CONTRAST TO AERATED SEAWATER, VELOCITY IS NOT A MAJOR FACTOR IN DETERMINING CORROSION RATE WITH DEAERATED SEAWATER, (3) INCREASED RESIDENCE TIME IN A CIRCULATED SYSTEM DECREASES CORROSION RATE WHEN THE OXYGEN CONCENTRATION IS IN THE RANGE OF 20 TO 100 PARTS PER BILLION. AT LOWER OXYGEN LEVELS, INCREASED RESIDENCE TIME INCREASES CORROSION, (4) AT EXTREMELY LOW OXYGEN LEVELS (LESS THAN 5 PARTS PER BILLION) ALL THE COPPER ALLOYS, REGARDLESS OF COMPOSITION, HAVE VERY LOW CORROSION RATES, AND (5) STEADY STATE CORROSION RATES (FOR LOW OXYGEN CONDITIONS) ARE ACHIEVED WITHIN THE FIRST FEW HOURS OF EXPOSURE.

*CORROSION + *CORROSION TESTS + *FABRICATION MATERIALS + ALUMINUM BRASSES + COPPER ALLOYS + DISTILLATION PROCESSES + EVAPORATORS + HEAT EXCHANGERS + NICKEL ALLOYS + OSW SPONSORED

30-01160 CASTLEBERRY JR

MATERIALS FOR DESALINATION EQUIPMENT TO BE STUDIED

MATER. PROTECT. 7(10), 17-19 (1968)

CONSTRUCTION OF A MATERIALS TEST CENTER BEGAN THIS MONTH NEAR FREEPORT, TEX., FOR EVALUATION OF THE CORROSION PERFORMANCE OF MATERIALS USED IN DESALINATION PLANTS. INITIAL PLANS AT THE NEW FACILITY WILL INVOLVE (1) A BASIC STUDY OF THE BEHAVIOR OF THE MOST PROMISING FAMILIES UNDER DESALINATION CONDITIONS, SPONSORED BY THE OSW, (2) A STUDY OF THE PERFORMANCE OF COPPER-BASED ALLOYS, SPONSORED BY THE COPPER DEVELOPMENT ASSOCIATION, (3) A STUDY OF THE PERFORMANCE OF ALUMINUM ALLOYS, SPONSORED BY THE ALUMINUM ASSOCIATION, (4) A STUDY OF THE PERFORMANCE OF STAINLESS STEEL ALLOYS, SPONSORED BY THE STAINLESS STEEL PRODUCERS COMMITTEE OF THE AMERICAN IRON AND STEEL INSTITUTE, (5) A STUDY OF SEAWATER CHEMISTRY (METHODS TO RENDER WATER LESS CORROSIVE), SPONSORED BY THE OSW, (6) A STUDY OF THE RELIABILITY OF COATINGS AND CATHODIC PROTECTION, THE EFFECTS OF IMPINGEMENT (EROSION), AND OTHER CAUSES OF DESALTING MATERIALS FAILURES, SPONSORED BY THE OSW. THE LONG RANGE GOAL OF THE TEST CENTER IS TO FIND HEAT EXCHANGER TUBE MATERIALS THAT WILL LAST 20 TO 30 YEARS. THE FACILITY WILL CONCENTRATE ON MATERIALS FOR THE LTV AND MSF PROCESSES.

*CORROSION + *FABRICATION MATERIALS + CORROSION TESTS + MULTISTAGE FLASH DISTILLATION + VERTICAL TUBE EVAPORATORS

CATEGORY 50 - OVERALL PLANT STUDIES

50-00959 BRICE DB

DESALTING - STATE OF THE ART

CALIFORNIA DEPT. WATER RESOURCES, SACRAMENTO

BULLETIN NO. 134-69, DEPT. WATER RESOURCES, STATE OF CALIFORNIA (JUNE 1969), 56 P, 30 FIG, 3 TABLES, 30 REF

THE WORLD-WIDE CAPACITY OF DESALTING PLANTS, BY THE END OF 1967, WAS ABOUT 220 MILLION GALLONS PER DAY. CONSTRUCTION WAS STARTED ON 45 PLANTS IN 1967. MOST SEAWATER DESALTING PLANTS CONTINUE TO EMPLOY THE DISTILLATION PROCESS, WHILE BRACKISH WATER PLANTS UTILIZE MEMBRANES. WHEN LARGE-CAPACITY DESALTERS ARE BUILT, IT IS EXPECTED THAT THE THERMAL DISTILLATION PROCESS, SUCH AS THE MULTISTAGE FLASH PROCESS, WILL BE USED. IT IS EXPECTED THE LARGE-CAPACITY PLANTS WILL USE NUCLEAR ENERGY FOR STEAM GENERATION. THE STEAM WILL BE USED FOR THE DUAL PURPOSE OF POWER GENERATION AND WATER DESALTING. DESALTING COSTS ARE EXPECTED TO BE REDUCED SUBSTANTIALLY OVER THE NEXT 20 YEARS. SUCH EXPECTATIONS ARE BASED ON ANTICIPATED TECHNOLOGICAL IMPROVEMENTS IN DESALTING PROCESSES AND NUCLEAR ENERGY PRODUCERS. THE ESTIMATED COST OF DESALTED WATER FROM LARGE-CAPACITY DUAL-PURPOSE FACILITIES, BASED ON CURRENT ESTIMATES AS INDICATED BY THE BOLSA ISLAND PROJECT, IS \$120 PER ACRE-FOOT (35 CENTS/1000 GAL) AT THE SITE. THIS ESTIMATE INCLUDES ESCALATION TO THE COMPLETION OF CONSTRUCTION OF THE PROJECT, ASSUMED TO BE 1974-1978.

*DISTILLATION PROCESSES + *NUCLEAR DESALINATION + *REVIEWS + DUAL-PURPOSE PLANT ECONOMICS + ENERGY SOURCES + FLOWSHEETS + METROPOLITAN WATER DISTRICT + MULTISTAGE FLASH DISTILLATION + NUCLEAR ENERGY SOURCES + SINGLE-PURPOSE PLANT ECONOMICS + SOUTHWEST UNITED STATES + SYSTEM DESCRIPTIONS + WATER COSTS ESTIMATE + WATER SOURCES + WATER UTILIZATION

50-01106 FIRST UNITED NATIONS DESALINATION PLANT OPERATION SURVEY

UNITED NATIONS, N.Y.

ST/ECA/112 (1969), (UN SALES NO. E.69.II.B.17), 122 P, 70 TABLES

THE SURVEY INCLUDES ALL PLANTS ENGAGED IN COMMERCIAL PRODUCTION FOR WHICH IT WAS POSSIBLE TO OBTAIN RECORDS OF OPERATION THROUGHOUT 1965. PLANTS WITH A CAPACITY OF LESS THAN 10,000 GPD, SPECIALIZED FEED-WATER PLANTS, AND EXPERIMENTAL PLANTS WERE EXCLUDED. EIGHTY-SEVEN PLANTS IN 21 COUNTRIES WERE SURVEYED. DATA WERE OBTAINED ON THE MSF, LTV, SUBMERGED-TUBE, AND VC DISTILLATION PROCESSES AND THE ELECTRODIALYSIS PROCESS. THE TOTAL PRODUCTIVE CAPACITY OF THESE PLANTS IS 24,994,000 GPD. MSF PLANTS ACCOUNT FOR MORE THAN TWO-THIRDS OF THE TOTAL PRODUCTION CAPACITY OF PLANTS OF ALL SIZES BUILT SINCE 1957 THROUGHOUT THE WORLD. TABLES ARE GIVEN COVERING THE ECONOMIC ANALYSIS, TECHNOLOGY, OPERATION, AND PRODUCTION AND STORAGE CAPACITIES FOR EACH OF THE PLANTS.

*DISTILLATION PROCESSES + *ELECTRODIALYSIS PROCESS + *OPERATING COSTS + *WATER COSTS ACTUAL + COST BREAKDOWNS + ECONOMIC EVALUATIONS + OPERATING EXPERIENCE + REVIEWS

CATEGORY 60 - SITING CONSIDERATIONS

- 60-01076 THOMSON DA + MEAD AR + SCHREIBER JR JR.
ENVIRONMENTAL IMPACT OF BRINE EFFLUENTS ON GULF OF CALIFORNIA
UNIVERSITY OF ARIZONA, TUCSON
OSW R+D PROGR. REPT. NO.387 (MAR.1969), 196 P, 42 FIG, 18 TABLES, 183 REF
AN EXTENSIVE REVIEW OF ALL AVAILABLE DATA AND INFORMATION ON THE NORTHERN GULF OF CALIFORNIA IS PRESENTED. SECTIONS INCLUDE GEOGRAPHY, GEOLOGY, METEOROLOGY, OCEANOGRAPHIC TEMPERATURE, SALINITY AND OXYGEN, TIDES, CURRENTS, WAVE ACTION, BATHYMETRY, SEDIMENTATION, RIVER FLOW, TURBIDITY, BIOLOGICAL FEATURES AND COMMERCIAL FISHERIES. PROBABLE EFFECTS OF THE EFFLUENT FROM A LARGE NUCLEAR DESALINATION AND POWER PLANT ON THE MARINE ENVIRONMENT ARE CONSIDERED. HOWEVER, LACK OF SUFFICIENT INFORMATION ON THE PROBABLE DISTRIBUTION AND MIXING OF THE BRINE EFFLUENT LEADS TO UNCERTAIN RESULTS. RECOMMENDATIONS FOR FURTHER STUDY ON METEOROLOGY, GEOLOGY, OCEANOGRAPHY, BIOLOGY AND EFFLUENT DISCHARGE ARE MADE.
*ECOLOGY + *OCEANOGRAPHY + *SITING SURVEYS + *WASTE DISPOSAL + *WATER BIOLOGY + CLIMATOLOGY + GEOGRAPHY + GEOLOGY + LITERATURE SURVEYS + MAPS + METEOROLOGY + MIXING + OSW SPONSORED + OXYGEN ANALYSIS + POLLUTION + SITE SELECTION CRITERIA + SOUTHWEST UNITED STATES
- 60-01088 ZEITOUN MA + MANDELLI EF + MCILHENNY WF
DISPOSAL OF THE EFFLUENTS FROM DESALINATION PLANTS INTO ESTUARINE WATERS
DOW CHEMICAL CO., MIDLAND, MICH.
OSW R+D PROGR. REPT. NO.415 (MAR.1969), 140 P, 10 TABLES, 14 FIG, 177 REF
THIS STUDY (1) EVALUATES THE QUANTITIES AND CHARACTERISTICS OF EFFLUENTS FROM DESALINATION PLANTS, (2) EVALUATES INCREMENTAL CHANGES IN ESTUARINE ENVIRONMENTS DUE TO EFFLUENTS, (3) DESCRIBES THE BIOLOGICAL EFFECTS OF THESE WASTES ON ESTUARIES AND IDENTIFIES LIMITING FACTORS, (4) IDENTIFIES ASSOCIATES RESEARCH AND DEVELOPMENT NEEDS, (5) DESCRIBES CASE STUDIES, AND (6) DESCRIBES METHODS OF PREVENTING POLLUTION OF ESTUARIES BY DESALINATION PLANTS. EQUATIONS ARE DEVELOPED FOR MIXING AND DIFFUSION OF EFFLUENTS. EFFECTS DUE TO TEMPERATURE, SALINITY, TURBIDITY, REDUCTION OF DISSOLVED OXYGEN, PH, ALKALINITY, PHOSPHORUS AND COPPER ARE DISCUSSED.
*POLLUTION + *WASTE DISPOSAL + *WATER BIOLOGY + COPPER + DIFFUSION + DISTILLATION PROCESSES + ECOLOGY + FREEZE PROCESSES + MEMBRANE PROCESSES + OCEANOGRAPHY + OSW SPONSORED + OXYGEN ANALYSIS + PH CONTROL + POINT LOMA PLANT + SALINE CONTAMINATION
- 60-01091 BOEGLY WJ + JACOBS DG + LOMENICK TF + SEALAND OM
THE FEASIBILITY OF DEEP-WELL INJECTION OF WASTE BRINE FROM INLAND DESALTING PLANTS
OAK RIDGE NATIONAL LABORATORY, TENN.
OSW R+D PROGR. REPT. NO.432 (MAR.69), 76 P, 7 FIG, 9 TABLES, 144 REF
A LITERATURE REVIEW SHOWS DEEP-WELL INJECTION OF BRINE EFFLUENTS TO BE TECHNICALLY FEASIBLE WITH PROPER PRETREATMENT. THE BRINE MUST BE FREE OF SUSPENDED SOLIDS AND CHEMICALLY STABLE SO THAT PRECIPITATES WILL NOT PLUG THE WELL. TREATMENT TO PREVENT BIOLOGICAL GROWTHS MAY BE NECESSARY. A PERMEABLE SEDIMENTARY FORMATION, SUCH AS SANDSTONE OR LIMESTONE, CAPPED BY AN IMPERMEABLE FORMATION, SUCH AS SHALE, IS REQUIRED TO PREVENT POLLUTION OF NEIGHBORING POTABLE WATER. DETAILED GEOLOGIC AND HYDROLOGIC INVESTIGATIONS ARE REQUIRED OF INDIVIDUAL SITES. DETAILS OF EXISTING WELLS, GEOLOGY AND PRETREATMENT ARE GIVEN WITH AN ECONOMIC ANALYSIS AND RECOMMENDATIONS.
*WASTE DISPOSAL + CHEMICAL ADDITIVES + CLARIFICATION + ECONOMIC EVALUATIONS + INLAND SITING + LITERATURE SURVEYS + OSW SPONSORED + POLLUTION + SITE SELECTION CRITERIA
- 60-01118 DEPUY GW
DISPOSAL OF BRINE EFFLUENTS FROM INLAND DESALTING PLANTS - REVIEW AND BIBLIOGRAPHY
BUREAU OF RECLAMATION, DENVER
OSW R+D PROGR. REPT. NO.454 (JULY 1969), 211 P, 870 REF
PART 1 OF AN 8-PART PROGRAM ON SURFACE FACILITIES FOR DISPOSAL OF DESALTING PLANT EFFLUENTS. THE PROGRAM CONSISTS OF (1) PREPARING A STATE-OF-THE-ART BIBLIOGRAPHY AND A REVIEW, (2) TEST SOIL SAMPLES FROM A PROPOSED BRINE EVAPORATION POND SITE, (3) LABORATORY TESTS ON POND LINING MATERIALS AND SOIL SEALANTS, (4) DEVELOP A MONITORING SYSTEM FOR SEEPAGE LOSS MEASUREMENT, (5) DEVELOP TECHNIQUES FOR INCREASING EVAPORATION RATES, (6) CONDUCT FIELD TESTS OF POND LININGS AND DEVELOP OPTIMUM APPLICATION METHODS, (7) PREPARE A MANUAL ON SURFACE FACILITIES FOR DISPOSAL OF DESALTING PLANT EFFLUENTS, AND (8) CONDUCT AN ECONOMIC STUDY OF SALT DISPOSAL. THE TECHNICAL LITERATURE WAS REVIEWED FOR INFORMATION ON ALL PARTS OF THE PROGRAM. A SURVEY OF 50 STATES AND THE FEDERAL WATER POLLUTION CONTROL ADMINISTRATION ON WATER POLLUTION REGULATIONS PERTAINING TO SURFACE FACILITIES FOR DISPOSAL OF DESALTING PLANT EFFLUENTS IS APPENDED TO THE REVIEW. REFERENCES ARE INDEXED AND CROSS-REFERENCED ACCORDING TO 18 SUBJECT AREAS.
*BIBLIOGRAPHIES + *WASTE DISPOSAL + CHEMICAL PRODUCTION + LITERATURE SURVEYS + OSW SPONSORED + POLLUTION + REVIEWS + SOIL STRUCTURE + WASTES
- 60-01126 COLLINS CW + KOLB JO
ECONOMIC VALUE OF ENGINEERED SAFETY FEATURES IN SITING OF DUAL-PURPOSE DESALTING PLANTS
OAK RIDGE NATIONAL LABORATORY, TENN.
ORNL-TM-2380 (MAR.1970), 76 P, 24 FIG, 14 TABLES, 21 REF
CONSTRUCTION OF LARGE DUAL-PURPOSE NUCLEAR DESALTING PLANTS WILL REQUIRE LARGE SITING DISTANCES OR EXTENSIVE USE OF ENGINEERED SAFETY FEATURES AT INCREASED CAPITAL COST TO REDUCE SITING DISTANCES. ECONOMICAL SITING OF NUCLEAR POWER DESALTING PLANTS THUS INVOLVES A BALANCE BETWEEN COSTS FOR SITING AND CONVEYING PRODUCTS TO LOAD CENTERS AND THE COSTS OF PROVIDING SUFFICIENT ENGINEERED SAFETY FEATURES TO REDUCE SITING DISTANCES FROM PRODUCT LOAD CENTERS. THIS REPORT COVERS A STUDY OF THE EFFECTIVENESS OF ENGINEERED SAFETY FEATURES IN REDUCING SITING DISTANCES, THE COST OF SITE ACQUISITION AND THE COST OF CONVEYING AND TRANSMITTING PRODUCT WATER AND ELECTRICITY IN VARIOUS QUANTITIES AS A FUNCTION OF DISTANCE, AND INVESTIGATION OF SEVERAL EXAMPLES OF ECONOMIC TRADE-OFF BETWEEN REACTOR ENGINEERED SAFETY FEATURES AND SITING COSTS.
*DUAL-PURPOSE PLANT + *ENGINEERED SAFEGUARDS + *NUCLEAR ENERGY SOURCES + *REACTOR SITING + BOILING-WATER REACTORS + ECONOMIC EVALUATIONS + ENERGY SOURCES + EXCLUSION ZONES +

ACCESSION NUMBER 60-01076 TO 60-01126

CATEGORY 60 - SITING CONSIDERATIONS

60-01126 *CONTINUED*

HIGH-TEMPERATURE GAS-COOLED REACTORS + INLAND SITING + LIQUID-METAL FAST-BREEDER REACTORS +
 MAXIMUM CREDIBLE ACCIDENT + NUCLEAR SAFETY PROBLEMS + OFFSHORE ISLAND SITING +
 POWER TRANSMISSION COSTS + REAL ESTATE COSTS + SITE SELECTION CRITERIA + WATER CONVEYANCE COSTS +
 3000 PLUS MW(T) REACTORS

60-01129 JASKE RT + KARR MH + TOUHILL CJ

MULTIPLE PURPOSE USE OF THERMAL CONDENSER DISCHARGES FROM LARGE NUCLEAR SYSTEMS TO SUPPLEMENT
 INTER-REGIONAL WATER SUPPLY

BMI, PACIFIC NORTHWEST LABORATORY, RICHLAND, WASH.

BNWL-SA-2738 (FEB.1970), 17 P, 3 TABLES, 2 FIG, 7 REF. PRESENTED AT A.I.CH.E. MEETING, ATLANTA, FEB.1970

A SOLUTION TO THE DILEMMA OF RISING NUCLEAR STATION COSTS, INCREASING OPPOSITION TO
 HYDRO DEVELOPMENT WHICH FLOODS USEFUL LAND AND CAUSES UNMANAGEABLE WATER FLOW
 FLUCTUATIONS WOULD BE THE CREATION OF A SYSTEM OF CANALS OF RELATIVELY LARGE SIZE - UP
 TO 15,000 CFS - WHICH WOULD BE USED AS ELONGATED COOLING PONDS FOR THE DISSIPATION OF
 CONDENSER HEAT OF LARGE DUPLEX-TYPE STATIONS.

*THERMAL POLLUTION + COOLING TOWERS + POLLUTION + SITE SELECTION CRITERIA

60-01130 JASKE RT + FLETCHER JF + WISE KR

A NATIONAL ESTIMATE OF PUBLIC AND INDUSTRIAL HEAT REJECTION REQUIREMENTS BY DECADES THROUGH THE
 YEAR 2000 AD

BMI, PACIFIC NORTHWEST LABORATORY, RICHLAND, WASH.

BNWL-SA-3052 (FEB.1970), 23 P, 3 TABLES, 9 FIG, 10 REF. PRESENTED AT A.I.CH.E. MEETING, ATLANTA, FEB.1970

A NATIONAL APPRAISAL OF THE IMPACT OF HEAT REJECTION REQUIRES REGIONAL STUDIES OF THE
 ECONOMIC PROCESSES THAT WILL GOVERN THE TYPE AND LOCATION OF INDUSTRIAL DEVELOPMENT.
 THE REPORT GIVES ESTIMATES OF REGIONAL HEAT REJECTION REQUIREMENTS AND EMPHASIZES THE
 MAJOR SOURCES OF HEAT, SUCH AS ELECTRIC POWER, TRANSPORTATION, AND CONVERSION
 INDUSTRIES. THE PROJECTED RATES OF GROWTH SHOW THAT BY THE YEAR 2000 THE U.S. WILL
 REJECT HEAT AT 3 TIMES THE PRESENT RATE. IN SOME AREAS, SUCH AS BETWEEN BOSTON AND
 WASHINGTON, THIS WILL AMOUNT TO 15 TO 50% OF THE SOLAR ENERGY INCIDENT ON THE AREA.

*THERMAL POLLUTION + DEMOGRAPHY + FEASIBILITY STUDY + POLLUTION + SITE SELECTION CRITERIA

CATEGORY 70 - INDUSTRIAL APPLICATIONS

70-00986 RITCHIE JA
NUCLEAR ENERGY CENTERS - THE PROBLEMS OF IMPLEMENTATION
OAK RIDGE NATIONAL LABORATORY, TENN.
ORNL-4295 (AUG.1969), 18 P

THIS ANALYSIS OF THE IMPLEMENTATION OF LARGE NUCLEAR-POWERED AGRO-INDUSTRIAL COMPLEXES IN DEVELOPING REGIONS OF THE WORLD ATTEMPTS TO IDENTIFY THOSE POTENTIAL PROBLEM AREAS WHICH COULD JEOPARDIZE THE SUCCESS OF THE PROJECT IF NOT GIVEN SUFFICIENT ATTENTION DURING THE PLANNING, CONSTRUCTION, OR OPERATING PHASES OF THE PROJECT. THESE AREAS INCLUDE POLITICAL, ECONOMIC, MANAGERIAL, INSTITUTIONAL, SOCIOLOGICAL, AND TECHNICAL. MOST OF THE THOUGHTS PRESENTED WERE OBTAINED FROM STUDIES OF LARGE PROJECTS UNDERTAKEN IN VARIOUS PARTS OF THE WORLD AND WERE GAINED BOTH FROM THE LITERATURE AND FROM PERSONAL INTERVIEWS WITH THE PARTICIPANTS IN THESE ENDEAVORS. THE CONTENT OF THIS DISCUSSION IS BASED ON REALITY OF EXPERIENCE RATHER THAN PURE SPECULATION. NO AMOUNT OF TECHNICAL FEASIBILITY WILL ENSURE THE SUCCESS OF AN AGRO-INDUSTRIAL COMPLEX UNLESS AND UNTIL THE PROBLEMS OF IMPLEMENTATION HAVE BEEN MET AND SOLVED. THIS WAS TRUE IN THE PAST CONCERNING DEVELOPMENT PROJECTS, IS EVEN MORE TRUE TODAY, AND CAN BE EXPECTED TO BE INCREASINGLY TRUE IN THE FUTURE. RECOMMENDATIONS ARE MADE TO INITIATE STUDIES ON MARKETING AND PRICING PARTICULARLY IN CONNECTION WITH A STUDY FOR A PARTICULAR SITE. THE ABILITY TO CONSIDER SPECIFICS RATHER THAN GENERALITIES WOULD AID UNDERSTANDING AND SHOULD ALSO PROVIDE A MODEL FOR POSSIBLE REFERENCE WHEN OTHER SITES ARE CONSIDERED.

*AGRICULTURE + *AGRO-INDUSTRIAL COMPLEXES + *REGIONAL PLANNING + AEC SPONSORED + DEMOGRAPHY + FEASIBILITY STUDY + SITE SELECTION CRITERIA + WATER UTILIZATION

70-01087 GCELLER HE + MROCHEK JE
GENERALIZED CAPITAL AND OPERATING COSTS FOR POWER-INTENSIVE AND ALLIED INDUSTRIES
OAK RIDGE NATIONAL LABORATORY, TENN.
ORNL-4296 (DEC.1969), 71 P, 37 TABLES

THIS REPORT SUPPLEMENTS CHAP.5 OF ORNL-4290, NUCLEAR ENERGY CENTERS - INDUSTRIAL AND AGRO-INDUSTRIAL COMPLEXES, BY PROVIDING THE READER WITH SUFFICIENT INFORMATION TO DUPLICATE THE COMPUTED COST RESULTS GIVEN IN CHAP.5 AND TO MAKE ADDITIONAL INDEPENDENT COST STUDIES ON THE 17 CHEMICAL AND METALLURGICAL PRODUCTS CONSIDERED. THE REPORT INCLUDES (1) ALL OF THE EQUATIONS AND CONSTANTS USED IN DETERMINING THE VARIOUS BUILDING BLOCK MANUFACTURING COST COMPONENTS, (2) A BRIEF DESCRIPTION OF THE COMPUTER SUBROUTINES, INCLUDING TYPICAL OUTPUT DATA SHEETS, AND (3) A SET OF TABLES FOR EASILY AND QUICKLY OBTAINING COMPONENT COSTS AT ALL OF THE REFERENCE VALUES OF ALL PARAMETERS USED IN THE STUDIES. A NUMBER OF WORKED EXAMPLES ARE GIVEN AT THE END OF THE REPORT TO ILLUSTRATE USE OF THESE DATA, FIRST FOR INDUSTRIAL BUILDING BLOCK COST DETERMINATIONS AND THEN FOR BOTH UNITED STATES AND NON-UNITED STATES INDUSTRIAL COMPLEXES.

*AGRO-INDUSTRIAL COMPLEXES + *CAPITALIZED COSTS + *REGIONAL PLANNING + AEC SPONSORED + CHEMICAL PRODUCTION + COST BREAKDOWNS + INVESTMENT (FIXED) + MULTIPURPOSE PLANT + OPERATING COSTS + PROGRAMS (COMPUTERS)

70-01095 FOURCY A + DUTHEIL F + DAMAGNEZ J
AN EXPERIMENTAL AGRICULTURAL STATION FOR DEMONSTRATION PURPOSES IN COMBINATION WITH A DESALTING FACILITY
CENTRE D ETUDES NUCLEAIRES DE GRENOBLE, FRANCE
PREPRINT OF PAPER SM-126/2 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT.20-24,1969, 15 P, 1 FIG, 11 REF

IF AN AGRO-INDUSTRIAL COMPLEX IS TO BE ECONOMIC, THE HIGH COST OF WATER MUST BE OFFSET BY A MAXIMUM YIELD OF AGRICULTURAL PRODUCTS. SINCE IT IS NOT EASY TO OBTAIN THE MAXIMUM YIELD IN AGRICULTURE WITHOUT CONSIDERING LOCAL AGRONOMIC AND HUMAN FACTORS, IT IS SUGGESTED THAT, BEFORE EMBARKING ON AMBITIOUS PROJECTS IN COUNTRIES OF LIMITED RESOURCES, AN EXPERIMENTAL STATION BE ESTABLISHED ALONGSIDE MULTIPURPOSE DESALTING FACILITIES. THE STATION WITH A STAFF OF 10 RESEARCH WORKERS AND THE NECESSARY TECHNICAL PERSONNEL IN AN AREA OF ABOUT 4 HECTARES SHOULD HAVE THE FUNCTIONS (1) ADAPTATION OF KNOWN AGRONOMIC DATA TO LOCAL CONDITIONS, (2) SELECTION OF APPROPRIATE CROPS AND MARKET RESEARCH TO DETERMINE THE BEST PRODUCTION CONDITIONS, (3) COMMERCIAL CALCULATIONS ON THE BASIS OF ACTUAL YIELD AT THE SITE, AND (4) TRAINING OF SPECIALIZED LOCAL PERSONNEL TO RELIEVE THE INITIAL STAFF. THE LAYOUT OF SUCH A STATION IS DESCRIBED WITH AN OUTLINE BALANCE SHEET AND PROGRAM OF WORK. THE ECONOMIC DEVELOPMENT POTENTIAL OF A FACILITY OF THIS TYPE IS DISCUSSED. (IN FRENCH)

*AGRICULTURE + *AGRO-INDUSTRIAL COMPLEXES + AGRONOMY + DESIGN + ECONOMIC CONDITIONS + LAYOUT + MULTIPURPOSE PLANT + WATER COSTS ESTIMATE

70-01101 MESSING T + LASAAR E
PRODUCTION OF POTABLE WATER AND SEA SALT
CHEM. PROCESS ENG. 49(8), 59-60 (1968), 4 FIG, 3 TABLES

A PLANT BUILT IN KUWAIT FOR THE PRODUCTION OF WATER AND COMMON SALT IS DESCRIBED. THE BRINE DISCHARGE FROM A WATER DISTILLATION PLANT IS FED INTO A 3-STAGE VACUUM EVAPORATOR PLANT. GYPSUM CRYSTALLIZES IN THE FIRST TWO STAGES AND SODIUM CHLORIDE IN THE THIRD. A SEPARATOR BETWEEN STAGES 2 AND 3 SEPARATES THE GYPSUM FROM THE BRINE. TO PREVENT SCALING IN THE FIRST TWO EVAPORATORS GYPSUM CRYSTALS ARE RECYCLED TO THE FEED SOLUTION. THE SALT CRYSTALS FROM THE THIRD EVAPORATOR ARE CENTRIFUGED, DRIED, CLASSIFIED, TREATED WITH MAGNESIUM CARBONATE, AND BOXED. THE DISTILLATE FROM THE EVAPORATORS IS COMBINED WITH THE POTABLE WATER FROM THE WATER PLANT.

*BY-PRODUCT MANUFACTURING PROCESSES + BY-PRODUCT ECONOMICS + CHEMICAL BY-PRODUCTS + DISTILLATION PROCESSES + EVAPORATORS + KUWAIT + SCALE PREVENTION + SEEDING PROCESSES

70-01131 THOMAS KT
ECONOMIC IMPACT OF NUCLEAR POWER AND DESALINATION IN DEVELOPING COUNTRIES
BHABHA ATOMIC RESEARCH CENTRE, BOMBAY
PREPRINT OF PAPER SM-126/10 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,

ACCESSION NUMBER 70-00986 TO 70-01131

CATEGORY 70 - INDUSTRIAL APPLICATIONS

70-01131 *CONTINUED*

ISTANBUL, TURKEY, OCT. 20-24, 1969, 39 P, 1 FIG

AN EVALUATION OF POSSIBLE IMPACT OF NUCLEAR POWER AND DESALINATION ON DEVELOPING COUNTRIES. IT EXAMINES IN DETAIL THE SCOPE FOR SUCH DEVELOPMENTS IN INDIA TAKING INTO CONSIDERATION THE PRESENT STATUS AND THE PROPOSED PROGRAM OF POWER DEVELOPMENT AND SHOWS HOW DEVELOPMENT OF NUCLEAR-POWERED AGRO-INDUSTRIAL COMPLEXES IN CERTAIN LOCALES COULD BE BENEFICIAL. TWO SUCH COMPLEXES, ONE USING UNDERGROUND WATER AND THE OTHER DESALTED WATER, ARE EXAMINED. THE TWO SITES CONSIDERED ARE - (1) AN INDO-GANGETIC SITE, WHERE POWER FROM TWO 1200 MWE NUCLEAR STATIONS WILL BE USED FOR PRODUCTION OF PHOSPHATIC AND NITROGENOUS FERTILIZERS, AS WELL AS ALUMINUM, AND FOR PUMPING OF UNDERGROUND WATER. FERTILIZERS AND WATER PRODUCED WILL BE USED ON SITE FOR AGRICULTURAL NEEDS. (2) KUTCH-SAURASHTRA SITE, WHERE DUAL-PURPOSE PLANT WILL PRODUCE 1200 MW ELECTRICITY AND 150 MGD OF DESALTED WATER. IN ADDITION TO PHOSPHATIC AND NITROGENOUS FERTILIZERS, ALUMINUM WILL ALSO BE PRODUCED TO CONSUME THE ELECTRICITY. AN ATTACHED AGRICULTURAL FARM WILL USE WATER FROM THE DESALTING PLANT, AND A MODEL FOOD FACTORY IS ENVISAGED. ECONOMIC USE OF HIGH-COST WATER FOR AGRICULTURE IN ARID ZONES WITH PROPER WATER AND AGRICULTURAL MANAGEMENT AND CROP ROTATION IS ANALYZED.

*AGRICULTURE + *AGRO-INDUSTRIAL COMPLEXES + *ECONOMIC EVALUATIONS + *WATER UTILIZATION + ALUMINUM + DUAL-PURPOSE PLANT + DUAL-PURPOSE PLANT ECONOMICS + FERTILIZER + INDIA + LAND UTILIZATION + NUCLEAR DESALINATION + NUCLEAR ENERGY SOURCES

70-01138 LEISERSON L + SCOTT PC

CHEMICALS FROM SEA WATER BRINES

OFFICE OF SALINE WATER, WASHINGTON, D.C.

OSW R+D PROGR. REPT. NO. 445 (AUG.1969), 25 P, 5 TABLES, 29 REF

THIS REPORT REVIEWS METHODS OF RECOVERY OF CHEMICALS FROM DESALTING PLANT EFFLUENTS, AND INDICATES AREAS OF RESEARCH RELEVANT TO THE ECONOMICAL RECOVERY OF VALUABLE MATERIALS FROM SEA OR BRACKISH WATER BRINES. IN DETERMINING WHICH CHEMICALS CAN BE RECOVERED PROFITABLY, A NUMBER OF FACTORS NEED TO BE CONSIDERED, SUCH AS THE ABUNDANCE OF THE CHEMICALS IN THE BRINE, TECHNICAL FEASIBILITY OF THE RECOVERY PROCESS, AND THE MARKET SUPPLY AND DEMAND. IT IS SHOWN THAT (1) SIX ELEMENTS, OR FIVE COMPOUNDS - SODIUM CHLORIDE, SODIUM SULFATE, MAGNESIA, BROMINE, AND POTASSIUM CHLORIDE - REPRESENT APPROXIMATELY 90% OF THE TOTAL MINERAL VALUE TO BE FOUND IN SEAWATER, (2) A MINERAL RECOVERY PROCESS MUST INCLUDE AT LEAST ONE OF THESE SUBSTANCES (OR A CLOSELY RELATED SUBSTITUTE, SUCH AS POTASSIUM SULFATE IN PLACE OF POTASSIUM CHLORIDE) TO BE ECONOMICALLY IMPORTANT TO A SALINE WATER CONVERSION PROCESS, (3) ON AN ANNUAL BASIS, THE VALUE OF THE FIVE MAJOR CONSTITUENTS OF A 3 TO 1 BRINE EFFLUENT FROM A 10 MGD DESALINATION PLANT IS ESTIMATED TO BE ABOUT \$14,400,000. THE VALUE OF WATER FROM THE PLANT (AT \$0.50 PER 1000 GAL) IS \$1,650,000. HENCE, THE MAJOR INDUSTRIAL OPPORTUNITY IN SEAWATER CONVERSION FROM A LARGE PLANT WILL ARISE FROM THE RECOVERY AND SALE OF CHEMICAL PRODUCTS, NOT WATER.

*BY-PRODUCT MANUFACTURING PROCESSES + *CHEMICAL BY-PRODUCTS + *CHEMICAL PRODUCTION + BRINE CONCENTRATION RATIO + BY-PRODUCT ECONOMICS + ECONOMIC EVALUATIONS + OSW SPONSORED + REVIEWS + WASTE DISPOSAL

70-01163 MICHEL JW + MROCHEK JE

RECENT DEVELOPMENTS IN ORNL'S AGRO-INDUSTRIAL COMPLEX STUDIES

OAK RIDGE NATIONAL LABORATORY, TENN.

PREPRINT OF PAPER SM-126/34 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT.20-24,1969, 14 P, 10 FIG, 11 REF

AN EXTENSION OF THE EARLIER WORK ON AGRO-INDUSTRIAL COMPLEXES AT ORNL HAS BEEN DEVOTED, IN PART, TO FURTHER OPTIMIZATION AND SENSITIVITY ANALYSES, TO A STUDY OF ADDING NEW ENTERPRISES TO THE COMPLEX, AND TO AN EXAMINATION OF SPECIFIC APPLICATIONS IN VARIOUS PARTS OF THE WORLD. THE RELATIVE ADVANTAGE OF THE ENERGY CENTER CONCEPT HAS BEEN FURTHER EXAMINED AND EXTENDED TO INCLUDE A SMALLER SCALE OF OPERATION WHICH, IN MANY CASES, OFFERS A MORE PRACTICAL APPROACH TO ACTUAL IMPLEMENTATION. THE SENSITIVITY ANALYSIS HAS EXAMINED THE EFFECTS WHICH CHANGES IN THE MANY ASSUMPTIONS HAVE ON THE OVERALL ECONOMICS OF THE AGRO-INDUSTRIAL COMPLEX. THIS INCLUDES CHANGES IN COMPLEX SIZE, PRODUCT MIX, TECHNOLOGY, PRICE LEVEL, CONSTRUCTION COST AND SCHEDULE, STARTUP SCHEDULE, WATER USE EFFICIENCY, ETC. THESE STUDIES HAVE HELPED TO DELINEATE THE CRITICAL ELEMENTS INHERENT IN THE DESIGN OF SUCH COMPLEXES. SEVERAL ADDITIONAL ENTERPRISES HAVE BEEN EVALUATED FOR INCLUSION IN THE ENERGY CENTER, AND MORE DETAILED STUDIES OF POSSIBLE COASTAL DESERT LOCALES HAVE EMPHASIZED THE IMPORTANCE OF INCORPORATING THE MANY SITE FACTORS, SUCH AS RAINFALL AND NEARNESS TO INDUSTRIAL RAW MATERIALS, IN DETERMINING THE COST AND BENEFIT CHARACTERISTICS OF SUCH COMPLEXES.

*AGRO-INDUSTRIAL COMPLEXES + *CHEMICAL PRODUCTION + *FERTILIZER + AEC SPONSORED + AGRICULTURE + ENERGY COSTS + ENERGY SOURCES + LAND UTILIZATION + MULTIPURPOSE PLANT ECONOMICS + NUCLEAR ENERGY SOURCES + SITE SELECTION CRITERIA + WATER UTILIZATION

70-01164 SPIEWAK I + HAMMCND RP

COSTS OF NUCLEAR DESALTING FOR ENERGY CENTERS

OAK RIDGE NATIONAL LABORATORY, TENN.

PREPRINT OF PAPER SM-126/35 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT.20-24,1969, 14 P, 4 FIG, 10 REF

AN ANALYSIS IS GIVEN OF RECENT ESTIMATES OF ENERGY AND DESALTED WATER COSTS TO SHOW THE COMPARATIVE IMPORTANCE OF FUEL COSTS, CAPITAL COSTS AND OTHER COMPONENTS OF ENERGY AND WATER COSTS. THE EFFECT OF SUCH PARAMETERS AS PLANT SIZE, INTEREST RATE, COST ESCALATION, AND LEVEL OF TECHNOLOGY IS PRESENTED. THOSE AREAS WHICH OFFER MOST FOR REDUCING WATER COST ARE DISCUSSED, INCLUDING THE ADVANTAGES OF SCALE AND OF IMPROVED TECHNOLOGY. THE INFLUENCE OF COST ESCALATION AND OF HIGHER INTEREST RATES ON DESALTING PROJECTS IS COMPARED TO THEIR INFLUENCE ON THE COST OF ALTERNATIVE WATER SOURCES. SURFACE WATER DEVELOPMENTS, WHICH ARE MOST CAPITAL INTENSIVE AND HAVE THE LONGEST CONSTRUCTION TIME, ARE HURT MOST BY RISING MONEY COSTS. GROUNDWATER PROJECTS, WHICH GENERALLY HAVE LOW CAPITAL COST AND SHORT CONSTRUCTION TIME, ARE LEAST AFFECTED.

ACCESSION NUMBER 70-01131 TO 70-01164

CATEGORY 70 - INDUSTRIAL APPLICATIONS

70-01164 *CONTINUED*

DESALTING PROJECTS ARE INTERMEDIATE. THE ADVANTAGES AND DISADVANTAGES OF DUAL-PURPOSE PLANTS ARE DISCUSSED AND A DESCRIPTION IS GIVEN OF PRESENTLY FEASIBLE ROUTES TO WATER-ONLY PLANTS. THESE INCLUDE THE VAPOR COMPRESSION PROCESS AND HIGH TEMPERATURE EVAPORATORS. FOR WIDELY USEFUL, LOW-COST DESALTING PLANTS TO BE AVAILABLE, SUCCESS MUST BE ACHIEVED IN SCALING UP PLANT SIZE AND ALSO IN IMPROVING AREAS OF TECHNOLOGY. THE STATUS OF DEVELOPMENTS ALONG THESE LINES IS DISCUSSED.

*AGRO-INDUSTRIAL COMPLEXES + *COST BREAKDOWNS + *ENERGY COSTS + *NUCLEAR DESALINATION + AEC SPONSORED + DUAL-PURPOSE PLANT + NUCLEAR ENERGY SOURCES + OSW SPONSORED + SINGLE-PURPOSE PLANT + WATER COSTS ESTIMATE

70-01165 YEE WC

INDUSTRIAL COMPLEXES BASED ON NUCLEAR DESALTING WASTE BRINES

OAK RIDGE NATIONAL LABORATORY, TENN.

PREPRINT OF PAPER SM-126/37 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT.20-24,1969, 23 P, 10 FIG, 13 REF

WASTE BRINES DISCHARGED FROM DUAL-PURPOSE NUCLEAR DESALINATION PLANTS CAN FORM THE BASIS FOR AN INDUSTRIAL COMPLEX. LOCATION OF SUCH PLANTS IN ARID COASTAL DESERT AREAS IMPLIES AN ABUNDANCE OF SOLAR ENERGY WHICH CAN BE USED TO SEQUENTIALLY SEPARATE OUT PRIMARY PRODUCTS SUCH AS GYPSUM, SOLAR SALT, POTASH AND MAGNESIUM CHLORIDE BY FRACTIONAL CRYSTALLIZATION. SECONDARY PRODUCT PRODUCTION INVOLVES USING ELECTRICAL AND STEAM ENERGY FROM THE DUAL-PURPOSE PLANT TO OBTAIN SULFURIC ACID AND CEMENT FROM GYPSUM, CAUSTIC SODA AND CHLORINE FROM SOLAR SALT, AND MAGNESIUM METAL FROM MAGNESIUM CHLORIDE. INTERNALLY, CAUSTIC SODA AND CHLORINE (AS HYDROCHLORIC ACID) CAN BE USED TO REMOVE BICARBONATE ION FROM SEAWATER PRIOR TO FRESH-WATER PRODUCTION. CAUSTIC SODA AND CHLORINE ARE ALSO THE BASIC CHEMICALS FOR A WHOLE ARRAY OF TERTIARY PRODUCTS SUCH AS PULP AND RAYON FROM GRAIN WASTES OF A NUCLEAR-POWERED AGRO-INDUSTRIAL COMPLEX, AND PVC PLASTICS AND CHLORINATED HYDROCARBONS WHEN A SOURCE OF PETROLEUM IS AVAILABLE. THE ECONOMICS OF EACH PROCESS BUILDING BLOCK ARE DISCUSSED IN THE ORDER OF THEIR SENSITIVITY TO THE COST OF ELECTRIC POWER. THIS IS FOLLOWED BY SEVERAL ILLUSTRATIONS OF INDUSTRIAL COMPLEXES BASED ON THESE BUILDING BLOCKS.

*AGRO-INDUSTRIAL COMPLEXES + *BY-PRODUCT MANUFACTURING PROCESSES + *DUAL-PURPOSE PLANT + *NUCLEAR DESALINATION + AEC SPONSORED + BY-PRODUCT ECONOMICS + CHEMICAL BY-PRODUCTS + CHEMICAL PRODUCTION + SOLAR ENERGY SOURCES + WASTE DISPOSAL

70-01166 MROCHEK JE + HOLMES JM + MICHEL JW

THE ROLE OF ELECTRICITY-INTENSIVE INDUSTRIES IN THE ECONOMICS OF NUCLEAR POWER

OAK RIDGE NATIONAL LABORATORY, TENN.

PREPRINT OF PAPER SM-126/38 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT, ISTANBUL, TURKEY, OCT.20-24,1969, 13 P, 6 FIG, 20 REF

NUCLEAR POWER REACTORS ARE STRONGLY DEPENDENT ON BASE LOAD OPERATION FOR PRODUCTION OF CHEAP ELECTRICITY. AS THE ROLE OF NUCLEAR POWER IN NATIONAL ENERGY PRODUCTION INCREASES, IT BECOMES MORE DIFFICULT TO MAINTAIN HIGH LOAD FACTORS ON INDIVIDUAL REACTORS WITH THE WIDE VARIABILITY OF ELECTRICITY DEMANDS. ELECTRICITY-INTENSIVE INDUSTRIES NEAR POWER GENERATING CENTERS MIGHT BE UTILIZED EITHER AS VARIABLE DEMAND LOADS OR AS INSTANT LOAD-SHEDDING DEVICES TO SMOOTH OUT ELECTRICITY DEMAND AND ENABLE EFFICIENT UTILIZATION OF CAPITAL-INTENSIVE GENERATING FACILITIES. THE POSSIBLE ROLE OF ELECTROLYTIC HYDROGEN PRODUCTION MIGHT BE EXAMINED IN DETAIL BY COMPARING TOTAL ANNUAL COSTS OF A NUCLEAR POWER STATION AND ELECTROLYTIC AMMONIA PLANT WITH THE SAME POWER STATION OPERATING AT A LOWER LOAD FACTOR. BOTH STATIONS PRODUCE THE SAME AMOUNT OF FIRM POWER FOR A HYPOTHETICAL GRID SYSTEM. FOR A 1000-MWE NUCLEAR POWER STATION AND A 300-TON/DAY AMMONIA PLANT A CREDIT OF \$3/TON FOR OXYGEN AND \$48/TON FOR AMMONIA ENABLES THE LOAD-LEVELIZED PLANT TO PRODUCE POWER FOR THE SAME TOTAL ANNUAL COSTS AS THE POWER PLANT ALONE OPERATING AT A LOAD FACTOR OF 79%. ADAPTABILITY OF OTHER ELECTRICITY-INTENSIVE INDUSTRIAL PROCESSES SUCH AS CHLORINE-CAUSTIC, ALUMINUM, MAGNESIUM METAL, ARC PRODUCTION OF ACETYLENE, ELECTRIC IRON, AND ELEMENTAL PHOSPHORUS AS LOAD-LEVELING DEVICES IS BRIEFLY DISCUSSED. A POTENTIAL NEAR TERM APPLICATION OF WATER ELECTROLYSIS AS A LOAD-LEVELING DEVICE IN INDIA IS ALSO PRESENTED.

*AGRO-INDUSTRIAL COMPLEXES + *CHEMICAL PRODUCTION + *MULTIPURPOSE PLANT + *MULTIPURPOSE PLANT ECONOMICS + AEC SPONSORED + BASE-LOAD + CHEMICAL BY-PRODUCTS + INDIA + NUCLEAR ENERGY SOURCES

CATEGORY 80 - WATER UTILIZATION

80-01083 BURLEY MJ + CLARKE JC

THE USE OF DESALINATION IN CONJUNCTION WITH CONVENTIONAL WATER SUPPLIES

WATER RESEARCH ASSOC., MEDMENHAM, ENGLAND, AND U.K. ATOMIC ENERGY AUTHORITY, RISLEY, ENGLAND
P. 617-30 IN NUCLEAR DESALINATION - PROC. IAEA SYMP., MADRID, NOV.1968, ELSEVIER, 1969. WAS PAPER
SM-113/48 AT SYMP.

THE USE OF DESALINATION PLANT IN CONJUNCTION WITH CONVENTIONAL FRESH-WATER RESOURCES IS REPORTED. THE INFREQUENT OPERATION OF DESALINATION IS USED TO MAINTAIN THE RELIABILITY OF A CONVENTIONAL WATER RESOURCE SYSTEM WHILE EFFECTIVELY INCREASING THE YIELD OF CONVENTIONAL WATER SUPPLY. BY THE PRODUCTION OF VERY EXPENSIVE DESALTED WATER IN DROUGHT PERIODS ONLY, AN ADDITIONAL QUANTITY OF ALMOST FREE WATER CAN BE TAKEN FROM AN IMPOUNDING RESERVOIR FOR THE REMAINDER OF THE TIME. THE OVERALL EFFECT IS TO PROVIDE THE INCREASED SUPPLY AT COSTS SOMETIMES AS LOW AS 50% OF THOSE ASSOCIATED WITH BASE-LOAD DESALINATION. COMPUTER ANALYSIS OF HYDROLOGICAL DATA HAS BEEN USED TO DEVELOP EFFICIENT OPERATING RULES FOR THE DESALINATION PLANT. A NUMBER OF EXISTING RESERVOIRS ARE CONSIDERED, AS ARE SEVERAL TYPES OF DESALINATION. BOTH SINGLE- AND DUAL-PURPOSE DISTILLATION AND ELECTRODIALYSIS ARE STUDIED FOR SUCH APPLICATIONS AND THE PARTICULAR CASE OF SUMMER-ONLY USAGE OF STEAM FROM DUAL-PURPOSE PLANT FOR DISTILLATION PURPOSES IS CONSIDERED.

*ECONOMIC EVALUATIONS + *WATER STORAGE + *WATER UTILIZATION + DUAL-PURPOSE PLANT +
FEASIBILITY STUDY + SINGLE-PURPOSE PLANT + WATER SOURCES

80-01098 LE CHATELIER J + CHARUIT P

MANAGEMENT OF THE WATER RESOURCES - AN ESSENTIAL FACTOR IN THE DEVELOPMENT OF A COUNTRY

SOFRED, PARIS, FRANCE

PREPRINT OF PAPER SM-126/5 PRESENTED AT IAEA SYMP. NUCL. ENERGY COSTS AND ECONOMIC DEVELOPMENT,
ISTANBUL, TURKEY, OCT.20-24,1969, 9 P, 6 REF

IN COASTAL REGIONS WHERE SEAWATER PROVIDES AN INEXHAUSTIBLE SOURCE OF FRESH WATER WHERE NECESSARY TREATMENT CAN BE ACCOMPLISHED AT REASONABLE COST, WORK MUST BE DIRECTED TO SUIT LOCAL CONDITIONS, WITH CONSIDERATION GIVEN TO USE OF (1) SOLAR ENERGY FOR SMALL-SCALE PRODUCTION AND (2) NUCLEAR ENERGY FOR LARGE-SCALE DESALTING BY EVAPORATION AS WELL AS FERTILIZER MANUFACTURE. THESE TWO ASPECTS ARE EXAMINED ON THE BASIS OF THE FOLLOWING - (1) THE WORK CARRIED OUT BY SOFRED AT THE CENTRE DE FOS-SUR-MER DES SALINS DU MIDI IN COLLABORATION WITH THE CENTRE HELIOTECHNIQUE DE MARSEILLE, RELATING MAINLY TO STUDY OF SOLAR ENERGY COLLECTORS CONNECTED WITH FLASH EVAPORATORS OR EVAPORATORS WITH LONG VERTICAL TUBES, AND (2) WORK BEING DONE BY ALSTHOM IN KUWAIT. CHARACTERISTICS AND PERFORMANCE DATA ARE EXAMINED ASSUMING - (1) AN INCREASE IN PRODUCTION, (2) NUCLEAR POWER SUPPLY, AND (3) JOINT WORK WITH A LOCAL CHEMICAL CONCERN. (IN FRENCH)

*NUCLEAR ENERGY SOURCES + *SOLAR ENERGY SOURCES + *WATER SOURCES + *WATER UTILIZATION +
AGRICULTURE + EVAPORATORS + FERTILIZER + FLASH EVAPORATION + INDUSTRIES + NUCLEAR DESALINATION +
VERTICAL TUBE EVAPORATORS

80-01133 OBRIEN JJ

OPPORTUNITIES FOR AUGMENTING WATER SUPPLIES THROUGH DESALTING

BUREAU OF RECLAMATION, WASHINGTON

PAPER PRESENTED AT A.I.C.H.E. MEETING, ATLANTA, FEB. 15-18, 1970

DURING THE NEXT 15 YEARS, WE SHOULD SEE A PROLIFERATION OF SMALL-SCALE DESALTING APPLICATIONS AS WELL AS THE INITIAL STEPS IN CONSTRUCTION AND OPERATION OF MODERATE SIZED PLANTS THAT WILL BE THE BUILDING BLOCK MODULES FOR THE VERY LARGE SIZED PLANTS OF THE FUTURE. A DESALTING PLANT COULD PROVIDE DROUGHT-PROOFING FOR AN INTERIM PERIOD AS ONE ALTERNATIVE THAT COULD BE INTEGRATED INTO ANY PLAN OF DEVELOPMENT TO MEET LONG-RANGE WATER NEEDS OF AN AREA WHETHER IT INCLUDES FURTHER DESALTING OR NOT. IT IS MISLEADING TO CONSIDER PRODUCTION COSTS AS THE TRUE COST OF DESALTED WATER WHEN CONSIDERING DESALTING TO AUGMENT ANOTHER WATER SUPPLY. MANY PLANNERS EXAMINING DESALTING AS AN ALTERNATIVE WOULD SAY THAT IF THE SUPPLEMENTAL SUPPLY WAS PROVIDED BY DESALTING, THE UNIT PRODUCTION COST WOULD BE REPRESENTED BY TOTAL ANNUAL COSTS DIVIDED BY THE SUPPLEMENTAL SUPPLY. HOWEVER, THE UNIT COST SHOULD BE COMPUTED AS THE ANNUAL COST DIVIDED BY THE TOTAL INCREASE IN CAPABILITY OF A REGIONAL SUPPLY WHICH WOULD INCLUDE WATER FROM OTHER SOURCES EVEN WHEN THE DESALTING PLANT WAS NOT OPERATING. THIS IS SIMILAR TO THE JUSTIFICATION AND AMORTIZATION OF THE COST OF A DAM BY THE TOTAL INCREASE IN CAPABILITY BROUGHT ABOUT BY VIRTUE OF ITS AVAILABILITY.

*AMORTIZATION CRITERIA + *WATER SOURCES + *WATER STORAGE + *WATER UTILIZATION + COST ALLOCATION +
ECONOMIC EVALUATIONS + SINGLE-PURPOSE PLANT ECONOMICS

CATEGORY 99 - MISCELLANEOUS

99-01070 EVALUATION OF CONCRETE AND RELATED MATERIALS FOR DESALINATION PLANTS

BUREAU OF RECLAMATION

OSW R+D PROGR. REPT. NO.345 (MAY 1968), 38 P, 21 FIG, 2 TABLES

A TEST PROGRAM SUMMARY REPORT ON (1) THE EVALUATION OF CONCRETE UNDER A VARIETY OF TEMPERATURE, PRESSURE AND BRINE CONCENTRATION CONDITIONS, (2) CONCRETE PANEL AND MODEL STRUCTURAL STUDIES, (3) SELECTION AND EVALUATION OF PROTECTIVE COATINGS, SEALANTS AND POLYMERIC PRODUCTS, (4) CONCRETE REINFORCEMENT MATERIALS, AND (5) CONCRETE MICROSTRUCTURAL INVESTIGATIONS. TEST DATA IS PRESENTED ON COMPRESSIVE STRENGTHS, MODULI OF ELASTICITY, POISSONS RATIO, TEMPERATURE DISTRIBUTION THROUGH WALLS IN HEATING AND COOLING CYCLES, CREEP DEFORMATION, DEPTH OF SURFACE ALTERATION, CORROSION OF REINFORCING BARS AND EVALUATION OF COATINGS AND POLYMERS.

*COATINGS + *CONCRETE CONSTRUCTION + *DESIGN DATA + *IMMERSION TESTS (CORROSION) + CORROSION + CORROSION TESTS + ELASTOMERS + EVAPORATOR SYSTEM DESIGN + EXPERIMENTAL DATA + OSW SPONSORED + PHYSICAL PROPERTIES + REINFORCEMENT + STRUCTURAL DESIGNS + SYNTHETIC RESINS (PLASTICS) + THERMAL CYCLING

99-01072 GUNAJI NN + KEYES CG JR

DISPOSAL OF BRINE BY SOLAR EVAPORATION

NEW MEXICO STATE UNIVERSITY

OSW R+D PROGR. REPT. NO.351, 213 P, 62 FIG, 38 TABLES, 65 REF

STUDIES OF THE EFFECT OF SALINITY AND DYES ON SOLAR EVAPORATION. TO DETERMINE EVAPORATION ACCURATELY, THE (1) MASS TRANSFER METHOD, (2) THE ENERGY BUDGET METHOD, AND (3) THE WATER BUDGET METHOD WERE INVESTIGATED. THE WATER BUDGET METHOD WAS SHOWN TO BE MORE RELIABLE THAN THE ENERGY BUDGET METHOD IN A MODIFIED CUMMINGS RADIATION INTEGRATOR. THE PROGRAM OBSERVED THE EFFECT OF BISMARCK BROWN, CONGO RED, METHYLENE BLUE, NAPHTHOL GREEN AND NIGROSINE DYES ON SOLAR EVAPORATION OF BRINE. USING THE WATER BUDGET METHOD, CALCULATIONS SUPPORTED THE HYPOTHESIS THAT THE NAPHTHOL GREEN DYE WILL INCREASE THE EVAPORATION OF BRINE MORE THAN THE OTHER DYES. A PLOT OF THE REDUCTION IN BOWENS RATIO IS GIVEN FOR VARIOUS SALINITIES.

*HUMIDIFICATION PROCESSES + *SOLAR ENERGY SOURCES + *WASTE DISPOSAL + CHEMICAL ADDITIVES + EVAPORATORS + EXPERIMENTAL DATA + OSW SPONSORED + PROGRAMS (COMPUTERS)

99-01074 MANNIGN JJ + PCRTER DJ

SOIL SEALING CHEMICALS AND TECHNIQUES

DIAMOND SHAMROCK CORP., PAINESVILLE, OHIO

OSW R+D PROGR. REPT. NO.381 (JUNE 1968), 30 P, 4 FIG, 11 TABLES

OVER 160 FORMULATIONS USING SOME 25 MATERIALS AND ADDITIVES WERE TESTED TO FIND MATERIALS TO RENDER SOILS IMPERVIOUS TO DESALINATION WASTE BRINE AND THUS PERMIT SAFE IMPOUNDMENT OF SUCH WASTES. FOUR CLASSES OF ADDITIVES RENDERED LOCAL SOIL SUITABLY IMPERVIOUS TO WASTE BRINE FROM THE ROSWELL, N.M., DEMONSTRATION PLANT - (1) LIGNIN DERIVATIVES GELLED WITH SODIUM CHROMATE OR ALUM, (2) CARBOXY METHYL CELLULOSE WITH ALUM, (3) PETROLEUM EMULSIONS, AND (4) AN ATTAPULGITE CLAY FORMULATION. SOIL PERMEABILITY WAS FOUND TO BE QUITE SENSITIVE TO ITS MOISTURE CONTENT WHEN COMPACTED, BEING MINIMUM AT THE MOISTURE CONTENT CORRESPONDING TO MAXIMUM DENSITY. TREATMENT COSTS FOR SEEPAGE OF LESS THAN 6 INCHES PER YEAR WITH 20 FOOT BRINE DEPTH WERE ESTIMATED AS LOW AS \$500/ACRE.

*SOIL STRUCTURE + *WASTE DISPOSAL + CANALS + CHEMICAL ADDITIVES + ECONOMIC EVALUATIONS + ORGANIC COMPOUNDS + OSW SPONSORED + ROSWELL PLANT

99-01075 FABUSS BM + KORCSI A

PROPERTIES OF SEA WATER AND SOLUTIONS CONTAINING SODIUM CHLORIDE, POTASSIUM CHLORIDE, SODIUM SULFATE AND MAGNESIUM SULFATE

MONSANTO RESEARCH CORP., EVERETT, MASS.

OSW R+D PROGR. REPT. NO.384 (1968), 139 P, 113 TABLES

PROPERTIES TABULATED ARE DENSITY, VAPOR PRESSURE, AND VISCOSITY. THESE ARE GIVEN FOR PURE WATER, BINARY AND TERNARY SOLUTIONS AND SEAWATER. THERMAL CONDUCTIVITIES ARE GIVEN FOR WATER AND SEAWATER. THE COMPOSITION OF SEAWATER IS GIVEN. DEFINITIONS ARE INCLUDED FOR THE ANALYTICAL CONCENTRATION FACTOR, THE PRACTICAL CONCENTRATION FACTOR, THE CHLORINITY AND THE SALINITY OF WATER. THE BOILING POINT ELEVATION OF SEAWATER IS TABULATED AS A FUNCTION OF TEMPERATURE VERSUS CONCENTRATION, SALINITY AND CHLORINITY. THE CORRELATION TECHNIQUES USED AND A COMPUTER PROGRAM FOR CALCULATING SEAWATER PROPERTIES ARE GIVEN.

*BOILING POINT ELEVATION + *PHYSICAL PROPERTIES + *SEAWATER CHEMICAL ANALYSIS + BRINE CONCENTRATION RATIO + DESIGN DATA + OSW SPONSORED + PROGRAMS (COMPUTERS) + THERMAL PROPERTIES

99-01077 PESSALL N + HULL FC + MICHAEL N + LIU C

DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER

WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.

OSW R+D PROGR. REPT. NO.394 (JAN.1969), 79 P, 30 FIG, 8 TABLES, 27 REF

BINARY TO MULTICOMPONENT IRON-BASE ALLOYS WERE PREPARED BY LEVITATION MELTING. LOOP TESTS AT 250 DEG F WITH DEAERATED SEAWATER PLUS ANODIC POLARIZATION CURVES WERE USED TO EVALUATE RELATIVE CORROSION BEHAVIOR. FOR EVALUATION THE ELECTROCHEMICAL METHOD IS PREFERRED. THE BEST CORROSION RESISTANT IRON ALLOYS ARE INDICATED TO BE MULTICOMPONENT, SINGLE PHASE ALLOYS CONTAINING CHROMIUM AND/OR ALUMINUM. ADDITIONS OF COBALT, MOLYBDENUM, NICKEL, NIOBIUM, SILICON, TUNGSTEN, SILVER, ZIRCONIUM, VANADIUM, AND TITANIUM ALL SHOW POTENTIAL FOR IMPROVING THE CORROSION RESISTANCE OF IRON-CHROMIUM AND IRON-ALUMINUM ALLOYS. STUDIES INDICATE THAT THE MELTING PRACTICE, PROCESSING PROCEDURE, ORIENTATION AND TRACE ELEMENTS HAVE LITTLE EFFECT ON CORROSION. FUTURE STUDIES ARE ITEMIZED.

*CORROSION + *CORROSION TESTS + *IRON ALLOYS + ALUMINUM + CHEMICAL ADDITIVES + CHROMIUM + GALVANIC CORROSION + OSW SPONSORED + PITTING (CORROSION) + STRESS CORROSION

99-01081 BURNAM CW + HOLLOWAY JR + DAVIS NF

THERMODYNAMIC PROPERTIES OF WATER TO 1,000 DEGREES C AND 10,000 BARS

ACCESSION NUMBER 99-01070 TO 99-01081

CATEGORY 99 - MISCELLANEOUS

99-01081 *CONTINUED*

PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY PARK

OSW R+D PROGR. REPT. NO.414 (MAR.1969), 90 P, 11 TABLES, 3 REF

THE SPECIFIC VOLUME OF WATER WAS DETERMINED EXPERIMENTALLY FROM 20 TO 900 DEG C AND FROM 1000 TO 8000 BARS. THESE DATA, TOGETHER WITH DATA UP TO 1000 BARS AND 800 DEG C FROM THE NATIONAL ENGINEERING LABORATORY STEAM TABLES 1964, WERE USED TO DERIVE THE TABLES OF THERMODYNAMIC PROPERTIES. ABOVE 8400 BARS AND 900 DEG C, THE TABULATED VALUES WERE OBTAINED BY EXTRAPOLATION WITH DERIVED FORMULAS. DATA IS PRESENTED ON SPECIFIC VOLUME, ENTROPY, ENTHALPY, GIBBS FREE ENERGY OF WATER, FUGACITY AND FUGACITY COEFFICIENTS.

*PHYSICAL PROPERTIES + *THERMAL PROPERTIES + *THERMODYNAMICS + OSW SPONSORED

99-01089 BEHRENS H + MARTIN F + OSBORN O + RICE L + RUSSELL W + SCHRIEBER C + WILLIAMS J

SEA WATER CORROSION TEST PROGRAM

DOM CHEMICAL CO., FREEPORT, TEX.

OSW R+D PROGR. REPT. NO.417 (MAR.1969), 29 REF, 108 P, 45 FIG, 6 TABLES

BEHAVIOR OF 6 COPPER ALLOYS UNDER DESALTING VARIABLES OF DISSOLVED OXYGEN, TEMPERATURE, REFRESHMENT RATE, PH, AND VELOCITY HAVE BEEN DETERMINED ON WEIGHT LOSS BASIS. OXYGEN IS THE MOST IMPORTANT FACTOR ON CORROSION RATE. CORROSION RATE ESSENTIALLY INDEPENDENT OF VELOCITY AT LESS THAN 5 PPB OXYGEN, NO DIFFERENCE IN CORROSION RATE BETWEEN ALLCYS OVER WIDE VELOCITY. FOR MEDIUM WATER REFRESHMENT RATE AT LOW OXYGEN CORROSION RATE UNAFFECTED BY TEMPERATURE 180-250 DEG F. HIGH REFRESHMENT RATE SHOWS 250 DEG F RATES 35% GREATER THAN 180 DEG F. ALUMINUM BRASS CORROSION RATES LESS THAN 90-10 COPPER-NICKEL, EQUAL TO 70-30 COPPER-NICKEL AT HIGH REFRESHMENT RATE AT LOW OXYGEN IN RANGE 180-250 DEG F. OPTIMUM PH AT LOW OXYGEN IS 7.8. AT LOW OXYGEN CORROSION RATE IS PH SENSITIVE, AND 70-90 PPB OXYGEN OVERSHADOWS PH EFFECT. EFFECT OF GENERATED SULFIDE CAN BE CONTROLLED BY OXYGEN. EFFECT OF WATER REFRESHMENT RATE ON CORROSION RATE TIED TO OXYGEN AND OXIDIZING CATIONS.

*COPPER ALLOYS + *CORROSION + FEEDWATER TREATMENT + HEAT EXCHANGERS + OSW SPONSORED + OXYGEN ANALYSIS + PH ADJUSTMENT

99-01090 EL-SWAIFY SA + SWINDALE LD + UEHARA G

SALINITY TOLERANCES OF CERTAIN TROPICAL SOILS AND RELATIONSHIPS BETWEEN SODIUM ION ACTIVITIES AND SOIL PHYSICAL PROPERTIES

UNIVERSITY OF HAWAII, HONOLULU

OSW R+D PROGR. REPT. NO.419 (MAR.1969), 74 REF, 49 P, 15 FIG, 14 TABLES

LABORATORY MEASUREMENTS WERE MADE OF THE ABILITY OF TWO SEMIARID TROPICAL SOILS TO RESIST PHYSICAL DETERIORATION BY SALINE WATERS. THE SALINITY EFFECT WAS MEASURED BY CONVENTIONAL MEANS AND ALSO BY A NEW TECHNIQUE INVOLVING THE DIRECT MEASUREMENT OF SODIUM ION ACTIVITIES. THE DIRECT DETERMINATION OF IONIC ACTIVITIES WAS DEVELOPED AS A NEW AND MORE FUNDAMENTAL TOOL IN SOIL SALINITY WORK. CHEMICAL AND PHYSICAL CHARACTERISTICS OF SOILS TESTED ARE TABULATED. SATURATED HYDRAULIC CONDUCTIVITY AND THE STABILITY OF SOIL AGGREGATES WERE USED AS INDICES OF SOIL PHYSICAL RESPONSE. CHANGES IN SOIL PH, CONCENTRATION OF SOIL SOLUTIONS, EXCHANGEABLE SODIUM AND MONOVALENT-DIVALENT CATION EXCHANGE EQUILIBRIA WERE DETERMINED.

*AGRICULTURE + *PRODUCT WATER BLENDING + *SOIL STRUCTURE + *WATER UTILIZATION + AGRONOMY + CHEMICAL PROPERTIES + EXPERIMENTAL DATA + LAND UTILIZATION + OSW SPONSORED + PH CONTROL + PHYSICAL PROPERTIES

99-01093 NEWTON JR + ATKINS ME

REPORT ON SEA WATER DESALINATION ANALYTICAL PROCEDURES

OFFICE OF SALINE WATER, WRIGHTSVILLE BEACH, N.C.

OSW R+D PROGR. REPT. NO.450 (MAY 1969), 133 P, 66 REF, 23 FIG

ANALYTICAL PROCEDURES ARE GIVEN FOR SEAWATER AND FOR SCALE. SEAWATER ANALYSES INCLUDE ALKALINITY, HARDNESS, BORON, BROMIDE, IODIDE, CALCIUM, MAGNESIUM, CARBON DIOXIDE, RESIDUAL CHLORINE, CHLOROSITY, COLIFORM, COPPER, DISSOLVED OXYGEN, FLUORIDE, IRON, LEAD, MANGANESE, NICKEL, OIL AND GREASE, PHOSPHATES, SILICA, SULFATES, IONIC SURFACTANTS AND VOLATILE HYDROCARBONS. SCALE ANALYSES INCLUDE CALCIUM, MAGNESIUM, CARBONATE, COPPER, DIFFERENTIAL THERMAL ANALYSIS, IGNITION LOSS, IRON, SILICA AND SULFATES.

*PHYSICAL CHEMISTRY OF SCALE + *SEAWATER CHEMICAL ANALYSIS + CARBON DIOXIDE ANALYSIS + COPPER + CORROSION + NICKEL + OXYGEN ANALYSIS + PH CONTROL + WATER BIOLOGY

99-01102 LUDERT JA + VAN STEEDEN AG

WATER DESALINATION PROCESSES

FILTRATION SEPARATION 5(6), 541-44 (1968), 2 FIG, 1 TABLE

THE EFFICIENCY AND ECONOMICS OF THREE DESALINATION PROCESSES, EVAPORATION, ELECTRODIALYSIS AND REVERSE OSMOSIS ARE DISCUSSED. DISTILLATION REQUIRES 12-15 KWH PER CUBIC METER, ELECTRODIALYSIS APPROXIMATELY 40 AND REVERSE OSMOSIS 8.4, ALL WITH SEAWATER FEED. THE COST OF ELECTRODIALYSIS DROPS TO 2 TO 2.5 KWH PER CUBIC METER AND REVERSE OSMOSIS TO 3.5 TO 4 WHEN BRACKISH WATER IS FED. THE SITUATION IN HOLLAND AS REGARDS FRESH WATER IS ALSO DISCUSSED.

*REVIEWS + DISTILLATION PROCESSES + ELECTRODIALYSIS PROCESS + MEMBRANE PROCESSES + OSMOSIS + WATER COSTS ESTIMATE + WATER UTILIZATION

99-01103 HCMER WA

NEW CONCEPTS FOR DESALTING BRACKISH WATER

J. AM. WATER WORKS ASSOC. 60(8), 669-81 (1968), 9 FIG, 3 TABLES, 15 REF

A NUMBER OF DESALTING PROCESSES ARE DESCRIBED, AMONG THEM DISTILLATION, VAPOR COMPRESSION, ELECTRODIALYSIS, REVERSE OSMOSIS, ION EXCHANGE, FREEZING, AND HYDRATE FORMATION. APPROXIMATE COSTS OF PRODUCT WATER FROM EACH PROCESS IS GIVEN WHERE AVAILABLE.

*REVIEWS + DISTILLATION PROCESSES + ECONOMIC EVALUATIONS + ELECTRODIALYSIS PROCESS + FLASH EVAPORATION + FREEZE PROCESSES + HYDRATE PROCESSES + ION EXCHANGING + MEMBRANE PROCESSES +

ACCESSION NUMBER 99-01081 TO 99-01103

CATEGORY 99 - MISCELLANEOUS

99-01103 *CONTINUED*
WATER COSTS ESTIMATE

99-01104 WILSON JR + CADWALLADER EA
DETERMINATION OF THE FEASIBILITY OF DESALTING SEAWATER
J. AM. WATER WORKS ASSOC. 60(1), 103-108 (1968), 4 FIG, 2 TABLES
A METHOD IS PRESENTED FOR DETERMINING THE COST OF A DESALTING PLANT BASED INITIALLY ON
(1) PLANT CAPACITY, (2) PLANT OPERATING FACTOR, AND (3) ECONOMY RATIO. FOUR
NOMOGRAPHS ARE GIVEN FROM WHICH (1) THE UNIT CAPITAL COST, (2) THE UNIT FIXED COST
COMPONENT, (3) THE UNIT FUEL COST, AND (4) THE UNIT LABOR COST MAY BE DETERMINED.
SUMMATION OF THE FIXED, LABOR, FUEL AND CHEMICAL UNIT COSTS RESULTS IN THE UNIT COST
OF WATER. CHEMICAL COSTS ARE ESTIMATED AS 8 CENTS/1000 GAL OF PRODUCT WATER. TABLES
SHOWING THE CONVEYING COST OF PRODUCT WATER AND EXAMPLES OF CAPITAL AND UNIT COSTS ARE
PRESENTED.

*ECONOMIC EVALUATIONS + CAPITALIZED COSTS + FEASIBILITY STUDY + FUEL COSTS + OPERATING COSTS +
SINGLE-PURPOSE PLANT ECONOMICS + WATER CONVEYANCE COSTS

99-01107 STEINBERG M + KUKACKA LE + COLOMBO P + KELSCH JJ + MANOWITZ B + KIKEOU JT +
BACKSTROM JE + RUBENSTEIN S
CONCRETE-POLYMER MATERIALS
BROOKHAVEN NATIONAL LABORATORY, UPTON, N.Y. + BUREAU OF RECLAMATION, DENVER, COLO.
BNL-50134 (T-509) (DEC.1968), 83 P, 43 FIG, 55 TABLES, 14 REF. ALSO LISTED AS USBR GEN. REP. 41
STUDIES INCLUDE THE DEVELOPMENT OF METHODS OF PREPARATION OF BOTH PREFORMED AND
PREMIXED CONCRETE-POLYMER COMPOSITES. THE DRIED CONCRETE IS SOAKED IN A MONOMER OR
MONOMER IS ADDED TO A FRESH CONCRETE MIX AND THE MONOMER POLYMERIZED IN SITU EITHER BY
RADIATION OR BY THERMAL-CATALYTIC TECHNIQUES. SOME OF THE IMPROVEMENTS FOUND OVER
UNTREATED CONTROLS WERE (1) COMPRESSIVE STRENGTH INCREASES OF 285%, (2) MODULUS OF
ELASTICITY INCREASES OF 80%, (3) TENSILE STRENGTH INCREASES OF 292%, (4) MODULUS OF
RUPTURE INCREASES OF 256%, (5) FREEZING AND THAWING IMPROVED BY GREATER THAN 300%, (6)
HARDNESS-IMPACT INCREASES OF 73%, (7) WATER PERMEABILITY DECREASES TO NEGLIGIBLE
VALUES, (8) WATER ABSORPTION DECREASES OF AS MUCH AS 95%, (9) REDUCTION OF CORROSION
BY DISTILLED WATER AND SULFATE BRINES TO NEGLIGIBLE VALUES COMPARED WITH THE SEVERE
ATTACK OBSERVED ON THE CONTROL SPECIMENS.

*CONCRETE CONSTRUCTION + *CONCRETES + AEC SPONSORED + CORROSION CONTROL + DISTILLATION PROCESSES +
FABRICATION MATERIALS + FLASH CHAMBERS + OSW SPONSORED + PIPES

99-01120 PATTERSON WL + BANKER RF
COMMUNITIES OF OVER 1000 POPULATION WITH WATER CONTAINING IN EXCESS OF 1000 PPM OF TOTAL DISSOLVED
SOLIDS
BLACK AND VEATCH, ENGRS., KANSAS CITY, MO.
OSW R+D PROGR. REPT. NO.462 (OCT.1969), 49 P, 2 TABLES, 2 FIG
THE LISTING INCLUDES THE 420 U.S. COMMUNITIES IN 29 STATES WHICH FIT INTO THE TITLE
DESCRIPTION. ONE LIST IS GIVEN BY STATES AND A SECOND LIST BY WATER RESOURCE REGION.
THE TDS FOR EACH LOCATION IS GIVEN.
*WATER SOURCES + BRACKISH WATER + CONTAMINANTS + OSW SPONSORED + PRODUCT WATER PURITY +
SALINE CONTAMINATION + WATER UTILIZATION

99-01123 BENDER RJ
WHY WATER DESALTING WILL EXPAND
POWER 113(8), 171-77 (1969)
A GENERAL REVIEW OF THE PRESENT STATUS OF DESALTING THROUGHOUT THE WORLD. THERE HAS
BEEN A DEFINITE UPWARD TREND IN THE NUMBER OF DESALTING INSTALLATIONS SINCE 1965. BY
THE END OF 1968, THE U.S. HAD ABOUT 300 LAND-BASED PLANTS OF 25,000 GPD OR GREATER,
FOR A TOTAL OF ABOUT 42 MGD. ABROAD, THERE WERE ABOUT 380 PLANTS WITH A TOTAL
CAPACITY OF 250 MGD. OF THESE PLANTS, 47 ARE NOW OF THE SIZE OF 1 MGD OR GREATER,
WITH A COMBINED CAPACITY OF 146 MGD. THE 7.5-MGD PLANT IN TIJUANA IS EXPECTED TO
PRODUCE WATER AT ABOUT 65 CENTS/1000 GAL AND PLANTS OF 100 TO 150 MGD, SUCH AS THOSE
PLANNED FOR THE LATE 70S, SHOULD BRING THE COST DOWN TO 40 CENTS/1000 GAL. LARGER
SIZE PLANTS ARE THE MAIN REASON FOR THIS COST REDUCTION. THE DISTILLATION PROCESS IS,
SO FAR, THE ONLY PROCESS USED COMMERCIALY BUT ELECTRODIALYSIS AND REVERSE OSMOSIS ARE
SERIOUS CONTENDERS WHEREVER THE SUPPLY WATER IS BRACKISH. THE ART OF DESALTING IS
MARKING TIME AT PRESENT AND THE DESALTING INDUSTRY NEEDS A SHOT IN THE ARM IN THE FORM
OF SOME NEW TECHNICAL BREAKTHROUGH.
*REVIEWS + DISTILLATION PROCESSES + DUAL-PURPOSE PLANT + ELECTRODIALYSIS PROCESS + ENERGY SOURCES +
FREEZE PROCESSES + MEMBRANE PROCESSES + WATER COSTS ESTIMATE

99-01125 WILLIAMS JS + HODGSON AS
DESALINATION PROCESSES FOR MILITARY APPLICATION
NAVAL CIVIL ENGINEERING LAB., PORT HUENEME, CALIF.
TECH. REPT. R-587 (JUNE 1968), 29 P, 17 FIG, 4 REF (AD 835 387)
A SUMMARY AND REVIEW OF THE DESALINATION PROCESSES CURRENTLY AVAILABLE WHICH LEND
THEMSELVES TO MILITARY APPLICATION. MEMBRANE PROCESSES (ELECTRODIALYSIS AND REVERSE
OSMOSIS) AND THERMAL PROCESSES (MULTISTAGE FLASH DISTILLATION AND VAPOR COMPRESSION
DISTILLATION) ARE EXPLAINED, AND EXAMPLES OF THE USE OF EACH TYPE OF EQUIPMENT ARE
CITED. DESIGN CRITERIA ARE GIVEN FOR MULTISTAGE FLASH DISTILLATION UNITS UTILIZING
WASTE HEAT FOR DIESEL GENERATORS. AN OPTIMIZATION PROCEDURE IS ALSO GIVEN FOR SIMILAR
UNITS USING DIRECT-FIRED BOILERS.
*DISTILLATION PROCESSES + *ELECTRODIALYSIS PROCESS + *MEMBRANE PROCESSES + *REVIEWS +
MULTISTAGE FLASH DISTILLATION + OSMOSIS + VAPOR COMPRESSION EVAPORATION + WASTE HEAT BOILERS

99-01128 SALINE WATER RESEARCH - PROGRESS SUMMARY - 1969
ENGINEERING DEPT., UNIV. CALIF., LOS ANGELES
REPT. 70-1, UCLA ENG. DEPT. (JAN.1970), 80 P
A BRIEF SUMMARY OF WORK IN PROGRESS DURING THE YEAR. CONTAINS THE SECTIONS (1) SALINE

ACCESSION NUMBER 99-01103 TO 99-01128

CATEGORY 99 - MISCELLANEOUS

99-01128 *CONTINUED*

WATER DEMINERALIZATION BY MEANS OF A SEMIPERMEABLE MEMBRANE, (2) MASS TRANSPORT OF ELECTROLYTES IN MEMBRANES, (3) SCALE CONTROL STUDIES, (4) SUBMERGED COMBUSTION, (5) DYNAMIC SEPARATION OF LIQUID SOLUTIONS, (6) HEAT AND MASS TRANSFER STUDIES, (7) CORROSION STUDIES, (8) ECONOMIC STUDY OF DESALINATION.

CARBON DIOXIDE ADDITION PROCESS + CORROSION + ECONOMIC EVALUATIONS + HEAT TRANSFER + MEMBRANE PROCESSES + SCALE PREVENTION + SCALING + STATUS REPORTS

99-01139 PESSALL N + HULL FC + LIU C

DEVELOPMENT OF A LOW-COST IRON-BASE ALLOY TO RESIST CORROSION IN HOT SEA WATER

WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.

OSW R+D PROGR. REPT. NO.478 (SEPT.1969), 76 P, 5 TABLES, 40 FIG, 39 REF

IRON-BASE ALLOYS, RANGING FROM BINARY ALLOYS OF IRON-CHROMIUM TO MULTICOMPONENT ALLOYS BASED ON IRON-CHROMIUM-MOLYBDENUM, HAVE BEEN PREPARED BY LEVITATION MELTING. THE RELATIVE RESISTANCES OF THE ALLOYS TO PITTING CORROSION IN DEAERATED SYNTHETIC SEAWATER, AT TEMPERATURES UP TO 250 DEG F, HAVE BEEN EVALUATED ON THE BASIS OF CRITICAL PITTING POTENTIALS, E(CRIT), OBTAINED FROM ANODIC POLARIZATION MEASUREMENTS. BASED ON STUDIES OF SYNERGISTIC INTERACTIONS, THE MOST PROMISING FERRITIC STEELS FOR USE IN AQUEOUS CHLORIDE ENVIRONMENTS HAVE BEEN FOUND IN THE IRON-CHROMIUM-MOLYBDENUM-COBALT ALLOY SYSTEM. A TENTATIVE CORRELATION BETWEEN E(CRIT) AND D-SHELL CHARACTER OF THE COMPONENT ELEMENTS OF QUATERNARY ALLOYS BASED ON IRON-CHROMIUM-MOLYBDENUM SUGGESTS THAT MULTICOMPONENT FERRITIC STEELS, CONTAINING CHROMIUM AND MOLYBDENUM AS MAJOR ADDITIVES IN COMBINATION WITH SMALL CONCENTRATIONS OF MOLYBDENUM, CHROMIUM, NICKEL, AND/OR COPPER, WILL HAVE EXCEPTIONALLY HIGH RESISTANCE TO PITTING ATTACK IN AQUEOUS CHLORIDE MEDIA.

*CORROSION + *FABRICATION MATERIALS + *IRON ALLOYS + CORROSION MECHANISMS + CORROSION TESTS + OSW SPONSORED

99-01156 MCILHENNY WF + ZEITCUN MA

A CHEMICAL ENGINEERS GUIDE TO SEAWATER

DOW CHEMICAL CO., FREEPORT, TEX.

CHEM. ENG. 76(24), 81-86 (1969) + 76(25), 251-56 (1969), 5 FIG, 8 TABLES, 13 REF

A GENERAL REVIEW OF THE PHYSICAL AND CHEMICAL PROPERTIES OF SEAWATER COVERING MATERIAL OF INTEREST TO CHEMICAL ENGINEERS FACED WITH THE DESIGN AND OPERATING PROBLEMS INVOLVING SEAWATER. THE PHYSICAL PROPERTIES OUTLINED INCLUDE SALINITY, SPECIFIC GRAVITY, VAPOR PRESSURE, FREEZING POINT, BOILING POINTS, OSMOTIC PRESSURE, SPECIFIC HEAT, THERMAL CONDUCTIVITY, SURFACE TENSION, AND VISCOSITY. THE CHEMICAL PROPERTIES COVERED INCLUDE COMPLEXATION, ORGANIC CONTENT, FOAMING, TURBIDITY, DEPOSITION OF SOLIDS, MARINE LIFE, BORERS, FOULING, SULFATE REDUCTION, AND DISPOSAL OF WASTE WATERS.

*CHEMICAL PROPERTIES + *PHYSICAL PROPERTIES + *SEAWATER CHEMICAL ANALYSIS + CHEMICAL PRODUCTION + REVIEWS

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LOUW JA		PECHENICK W		30-01105
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LU CH		PESSALL N		30-01080
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LUDERT JA		PIERAZZI L		30-00992
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K. O. Johnsson

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Oak Ridge National Laboratory, Tenn.

ORNL-NDIC-7 (September 1970), 68 p

Abstracts are given for approximately 210 published articles related to the desalination of seawater. The body of the report is a copy of information stored in a computerized storage and retrieval system for the Nuclear Desalination Information Center (NDIC) at the Oak Ridge National Laboratory. The abstracts are grouped in nine categories (and repeated if they fall into more than one category). An author and a keyword index to the articles referenced is provided. The keywords, which identify the content of the articles, were chosen from a thesaurus developed by NDIC.

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