ENFORM: An ENergy InFORMation System

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PREFACE

The operation of nuclear fuel cycle facilities will introduce noxious materials, both radiological and chemical, into the environment through routine discharges of both liquid and airborne effluents. The environmental implications of continued development of existing nuclear fuel cycles and implementation of new fuel cycles must be determined systematically to assure the timely development and demonstration of technologies which control or eliminate the discharge of these materials.

To address this need for a comprehensive systems analysis of effluent control technologies for the nuclear fuel cycles, ERDA's Division of Environmental Control Technology has initiated a program, Analysis of Nuclear Fuel Cycles, at Battelle, Pacific Northwest Laboratories (PNL). The objective of this program is to identify areas in developing nuclear fuel cycles (1) where environmental controls seem to be inadequate, (2) where inconsistencies and conflicts exist in environmental policy, and (3) where improved environmental controls can be justified on a cost/benefit basis (i.e., ensure that funds are not expended in cases where neither potential effects nor public concerns warrant such expenditures). The program initially focuses on current and "near future" LWR technology. Later work will focus on cost/benefit analyses of advanced LWR alternatives and alternative control technologies for LMFBF fuel cycles. Further work will concentrate on analyzing other advanced nuclear energy systems (e.g., fusion) and integrating results from the various energy technology studies to evaluate the environmental control technology of the nuclear industry.

This report is one of approximately ten that will be published during the course of the program. The first three reports to be published describe the analytical tools used in the study. Since these analytical methodologies have applications far beyond the scope of this study, they deserve special attention, particularly by those engaged in environmental analyses and cost/benefit studies of environmental impacts. These documents are:

ENFORM: An ENergy InFORMation System, BNWL-2195, by C. M. Heeb,
W. L. Purcell, and B. M. Cole.

Procedures for Estimating Nuclear Fuel Cycle Costs, BNWL-2210,
by John Young.

Environmental Assessment Methodology for the Nuclear Fuel Cycle,
BNWL-2219, by D. L. Brenchley.

The remaining reports will describe the nuclear fuel cycle facilities
to be studied and the results of our analyses.

These reports are all available from the National Technical Information
Service.

T. J. Kabele
Project Manager

SUMMARY

The ENFORM system of computer codes can be used to calculate the amount of fuel material in the nuclear fuel cycle as a function of time. The material amounts are determined by an input schedule of installed electric energy generation capacity. In addition to the amount of uranium and plutonium in the fuel cycle, the system also accounts for 175 radionuclides.

The effect of the fuel cycle on the environment can be calculated for the release of radionuclides and chemicals. The released radionuclides are modeled through the use of release factors and dose coefficients applied to the contained isotopic inventories. The chemical effluents released to the environment are modeled by using simple release factors. All release factors and dose coefficients are specific for each type of plant in the nuclear fuel cycle.

The material logistics and effluent accounting features of the ENFORM system are supplemented by a fuel cycle economics package. This module provides fuel cycle processing costs and the levelized cost of power.

The ENFORM system also provides means of estimating the effect of changing nuclear growth scenarios and changing environmental control technologies on nuclear fuel cycle effluents, economics and logistics.

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INTRODUCTION

ENFORM is a computer-based information system addressing the economics and material logistics of large-scale electric energy generation. The most important system inputs consist of electric energy generation requirements, details of plant construction scheduling, unit costs, and environmental release factors. From these inputs the ENFORM system computes the mass balances and generates the environmental releases of noxious chemicals and radionuclides from each type of plant in the fuel cycle. Fuel cycle costs and electric power costs are also computed so that cost-benefits can be assessed for various electric generation schedules (scenarios).

Much of the descriptive material contained here is of a general nature, dealing primarily with the design of the ENFORM system, while other sections of the report describe in detail the present version of the system, i.e., ENFORM-I, which is restricted to the modeling of LWRs. The designations ENFORM and ENFORM-I are used to distinguish between the general and the specific current properties of the computer codes.

This document describes not only the general system design but also ENFORM-I capabilities. It is not a user's manual and thus does not provide detailed programming information. Future versions of ENFORM will be extended to describe the economics and material logistics of LMFBRs (ENFORM-II), the LWR thorium fuel cycle, and perhaps fossil energy generation, all of which can be incorporated comfortably within the overall system design.

GENERAL SYSTEM DESCRIPTION

A general schematic of the ENFORM system is shown in Figure 1. The input scenario, which is a table of installed nuclear generation capacity and capacity factor (that is, fraction of calendar time the plant is operating at stated capacity), is provided by year for PWRs and BWRs in the ENFORM-I version. The arithmetic product of installed capacity and capacity factor determines the energy generated in that year for that reactor type.

The Data Base Generator "solves" the fuel cycle logistics problem based on the input scenario. "Solves" means that the amount of uranium and plutonium required to generate the electric power specified by the scenario is determined, and that the point in time that the material is required is calculated for all of the steps in the fuel cycle from the uranium mine through the reprocessing plant. Both uranium and plutonium recycle are available as options. A report is written which summarizes the material flows and provides fuel cycle cost information. In addition, a massive data base is generated which contains not only the distribution in time of bulk uranium and plutonium in the fuel cycle but also the distribution of nearly 180 important radionuclides. A sample case is displayed in Appendix A.

After the data base has been generated in Pass I (Figure 1), the Report Writer module is instructed by additional input in Pass II to interrogate the data base and produce a report on any part of the data base specified, or on the entire data base. For radionuclide emissions, releases in units of radioactivity or dose can be specified. Chemical releases are specified in mass units per year per facility.

Chemical releases and radionuclide doses are not stored in the data base but are generated as needed. The data base contains the amounts of material processed in a given time period. The Report Writer module contains chemical release factors which give the amount of a given chemical release per amount of fuel material processed by the plant, i.e., kilograms of uranium. The amount of the release is merely the product of the fuel material (from the data base) and the release factor.

FIGURE 1. ENFORM General System Design

Dose from released radionuclides is similarly calculated except that both a dose coefficient (dose per curie released) and a release factor in terms of curies released per curie processed is required. The source term which is the amount of each radionuclide processed is contained explicitly in the data base. This is different from the chemical release calculation which is based merely on the gross amount of plant product processed. The technique of "calculate on demand" saves much information storage space and may be less expensive than retrieval from a complete, but more unwieldy, data base.

Pass I and Pass II must be repeated for each scenario. Eventually a set of data bases can be accumulated which will accommodate repeated interrogation. Technical changes in fuel cycle material release factors and shifts in interest to other radionuclides or chemical effluents not previously requested may make several interrogations necessary.

The organization of the data base is conveniently visualized in terms of a "library" of three dimensional "volumes." The three dimensions of every volume are:

1. Time (ENFORM-I uses years)
2. Process plant module (mine, mill, conversion, etc.)
3. Material chain

The first two dimensions are self-explanatory, but some explanation for the material chain dimension is in order. A material chain is defined as a pathway through the fuel cycle for each type of material required by the reactor at any stage in its life. A chain is thus characterized by reactor type (i.e., PWR), by initial enrichment, and by final discharge exposure. A PWR, which normally replaces one-third of the core at each refueling, would have three chains for the first core, perhaps one unique first reload enrichment, and an equilibrium reload enrichment which would remain constant for all subsequent reloads. Thus, five chains would be necessary to represent the range of fuel material required for a PWR.

The advantage of describing the flow of fuel material through the fuel cycle in terms of these "chains" is that burnup and decay can be calculated "in advance" for each chain and the results can be stored away as a set of time-dependent coefficients. The coefficients are in units of isotopic mass per weight of fuel loaded into the core at the beginning of the irradiation cycle. When a particular input scenario is being calculated, it is only necessary to know the amount of fuel material charged in that particular "chain." In order to calculate the isotopic content exactly for each time period, the isotopic coefficient is multiplied by the mass of material charged.

A "volume" in the data base library contains the total amount of fuel material or the total amount of a given isotope. These amounts are distributed over chain, process step, and time (years) within each volume. The structure of the data base library is illustrated in Figure 2.

FIGURE 2. Data Base Structure

The first task to be accomplished by the Data Base Generator is to allocate fuel material to the various chains according to the input scenario. This is first done without considering uranium or plutonium recycle, thereby establishing a maximum pool of material available for recycle. Then a second pass through time is made which modifies the previous amounts by whatever recycle option is specified in the input. The material flow for a nonrecycle and recycle chain set is illustrated in Figure 3.

When the first Data Base Volume (DBV) containing the weight of uranium and plutonium is written, the Data Base Generator (DBG) prints the isotopic volumes by using the contents of the first volume and the isotopic coefficient files. The isotopic files were generated with the ORIGEN⁽¹⁾ computer code.

The DBG and the Report Writer (RPW) modules both make use of files that are the result of external computations such as transmutation, dose rate, release factors, fixed isotopic compositions, etc. This type of file is referred to as a Template File (TPF) to distinguish it from the data base proper. The Template Files are valid for all scenarios, while the data base is strictly scenario-dependent. The final task of the DBG is to produce a report which summarizes the mass flows and pertinent fuel cycle cost information.

After the data base has been completed for a given scenario, the Report Writer (RPW) module receives from the user specific instructions which define those portions of the data base to be interrogated and the form to be used in printing the results of the interrogation. A sample case for the Report Writer is given in Appendix B. The computational procedure is a straightforward multiplication of the amount of material by the release factor, followed perhaps by further multiplications of unit conversion factors. The release factors and conversion factors are stored on template files which are accessed by the RPW during execution.

FIGURE 3. Two Sample Processing Chains

DESCRIPTION OF THE FUEL CYCLE MODEL

This section describes the major components of the ENFORM-I model, i.e., the plants and the chains.

THE PLANTS

Table 1 lists the various plants of the fuel cycle contained in the ENFORM-I model. The residence time of a given material in any of these plant types can be specified in units of quarter years.

There are two types of uranium mines contained in the model. The ore grade may be specified by year for each of the two mine types, and the amount produced from each mine type (i.e., production split) can be specified by input. The split in output production between the two mill types can also be specified by input.

TABLE 1. ENFORM-I Model Plants

<u>Plant Index</u>	<u>Plant Name</u>
1	Open Pit Uranium Mine
2	Underground Uranium Mine
3	Uranium Mill Employing the Acid Leach Process
4	Uranium Mill Employing the Alkaline Leach Process
5	UF ₆ Conversion Plant, Aqueous Process
6	Uranium Enrichment, Gaseous Diffusion
7	Fuel Fabrication, Uranium Oxide
8	Fuel Fabrication, Plutonium-Uranium Oxide
9	Pressurized Water Reactor (PWR)
10	Boiling Water Reactor (BWR)
11	Reactor Spent Fuel Storage
12	Interim Spent Fuel Storage
13	Reprocessing

There are also two types of fabrication plants (UO_2 plant and mixed oxide plant); their production split cannot be specified because the code does it automatically based on the plutonium recycle specified by the scenario.

The amount of fuel processed in the PWR and the BWR is determined completely by the input energy generation scenario. All of the power is generated in one or the other of the two generic LWR types. The key properties of the generic reactors are contained in Tables 2 and 3. The design capacity factor (Item 6 from Tables 2 and 3) is used to determine the residence time of the fuel in the reactor. An annual refueling is assumed when the input capacity factor matches the design capacity factor. When the input capacity factor is less, residence time is increased proportionately, and decreased when it is more than the design value.

TABLE 2. The Reference PWR

<u>No.</u>	<u>Datum</u>	<u>Value</u>	<u>Unit</u>
1	Core Thermal Power	3411	MW_t
2	Net Electric Power	1156	MW_e
3	Assembly Weight (U)	461.5	kg
4	Core Fuel Weight (U)	89.1	MTM
5	Thermal Efficiency	0.3389	--
6	Design Capacity Factor	0.7867	--
7	Assembly Rod Array	17 x 17	--
8	Rod Pitch	1.2598	cm
9	Pellet Density	95	% Theo.
10	Pellet Diameter	0.8192	cm
11	Fuel Rod Outer Diameter	0.9500	cm
12	Clad Thickness	0.05715	cm
13	Reload Batch Size	0.3333	Core Fraction

TABLE 3. The Reference BWR

No.	Datum	Value	Unit
1	Core Thermal Power	3800	MW _t
2	Net Electric Power	1277.0	MW _e
3	Assembly Weight (U)	188.6	kg
4	Core Fuel Weight (U)	159.93	MTM
5	Thermal Efficiency	0.3361	--
6	Design Capacity Factor	0.7779	--
7	Assembly Rod Array	8 x 8	--
8	Rod Pitch	1.6256	cm
9	Pellet Density	95	% Theo.
10	Pellet Diameter	1.0566	cm
11	Fuel Rod Outer Diameter	1.2522	cm
12	Clad Thickness	0.08636	cm
13	Reload Batch Size	0.2500	Core Fraction

Two postirradiation storage facilities are modeled. The first of these is assumed to be located at the reactor; the second is located "elsewhere."

The reprocessing plant is assumed to separate the spent fuel composition into uranium, plutonium and the residual radionuclides. This latter category is referred to as rad waste. The separation is done with an input efficiency factor for uranium and plutonium. For example, if an efficiency factor of 99.5% is specified for plutonium, then 0.5% of each plutonium isotope goes into rad waste.

The rate at which reprocessing plants can be built is controlled in various ways. If there are no reprocessing plants, the spent fuel is stored until the plants begin operation. The backlog of spent fuel is worked off on a first-in, first-out (FIFO) basis. The startup date and the designed capacity of each plant can be specified, and this capacity can be reached over a 3-year period in increments also specifiable by the user. If the requested construction schedule causes excessive reprocessing capacity--that is, if there is not

enough fuel available for reprocessing--then the requested schedule is delayed until the spent fuel supply and reprocessing capacity match. A minimum backlog may also be specified. If the specification of reprocessing plants is not complete, then a reference plant is brought on-line at intervals given by the input to work off the spent fuel backlog.

In ENFORM-I the fuel cycle stops at the end of reprocessing. Waste disposal will be treated by another information system⁽²⁾ which will use the ENFORM-I data base as input.

THE CHAINS

The material chains that are currently used in ENFORM-I are shown in Table 4. An ORIGIN case is used for each of these chains to determine the isotopic composition from the reactor through reprocessing. Neutron spectrum and the neutron cross sections are adjusted in the ORIGIN cases until reasonable agreement with measured isotopic data is reached.⁽³⁾

The results of each ORIGIN case are stored on tape for all 808 isotopes in the ORIGIN library. The ORIGIN tapes are then processed by an editor code to produce a compacted disc file which is accessed by the DBG during execution to produce the set of isotopic volumes for the data base.

The restriction to chains of fixed composition leads to some minor approximations in the case of plutonium recycle. However, an interpolation technique has been developed which can deal with variations of detailed fuel batch isotopic composition within the framework of fixed chain compositions. This technique was not implemented in ENFORM-I because the isotopic compositions are accurate for most realistic scenarios. However, it is available as a means of dealing with batch compositions which vary more widely.

A double set of isotopics is used in ENFORM. The primary set represents the oxide fuel pellet; the other represents only the cladding and structural material in the fuel assembly. In the reprocessing plant a partitioning of these two materials occurs at the dissolver. To reflect this partitioning an additional set of template isotopic files is constructed which is accessed

TABLE 4. ENFORM-I Material Chain Specifications

<u>Chain Number</u>	<u>Reactor</u>	<u>Enrichment w/o Fissile</u>	<u>Discharge Exposure MWD/MTM</u>	<u>Description</u>
1	PWR	2.00	15000	First Core, Region 1
2	PWR	2.60	25000	2
3	PWR	3.10	33000	3
4	PWR	3.20	33000	First Reload
5	PWR	3.20	33000	Equilibrium Reload
6	BWR	1.70	10000	First Core, Batch 1
7	BWR	1.90	17000	2
8	BWR	1.90	20000	3
9	BWR	1.90	21000	4
10	BWR	2.70	26000	First Reload
11	BWR	2.60	27000	Equilibrium Reload
12	PWR	3.55	33000	First Uranium Recycle
13	PWR	4.73	33000	Second Uranium Recycle
14	PWR	9.09	33000	Third Uranium Recycle
15	BWR	2.88	27000	First Uranium Recycle
16	BWR	3.83	27000	Second Uranium Recycle
17	BWR	7.43	27000	Third Uranium Recycle
18	PWR	3.98	33000	First Plutonium Recycle
19	PWR	7.08	33000	Second Plutonium Recycle
20	PWR	13.00	33000	Third Plutonium Recycle
21	BWR	2.78	27000	First Plutonium Recycle
22	BWR	3.76	27000	Second Plutonium Recycle
23	BWR	6.49	27000	Third Plutonium Recycle

during a Pass I execution to produce an additional set of volumes in the data base. This additional set represents the isotopic content of the structural material and its neutron activation products.

Uranium Recycle

The neutron reactivity penalty associated with the buildup of the ^{236}U isotope is assumed to be compensated by an increased feed enrichment requirement. In principle, determining the final ^{235}U concentration for each batch of uranium available to recycle is an iterative process. ENFORM-I uses a ^{236}U penalty of 0.3 weight percent (w/o) additional ^{235}U for each 1.0 w/o ^{236}U . (4) Because the enrichment process changes the amount of ^{234}U and ^{236}U in a predictable way, the product material will not reflect this ^{236}U penalty exactly. It is thus necessary to repeat the process with a slightly higher concentration of ^{235}U and to continue the process until the cascade product reflects the correct ^{236}U penalty in the fissile composition. In practice, the process converges very rapidly within 15 iterations.

When reprocessing starts before the beginning of recycle, the uranium pool from which the recycle material is drawn is worked off on a FIFO basis. Both the beginning of reprocessing and the beginning of recycle can be specified independently.

Once a beginning date for recycle is specified, then all available uranium is sent into successive recycles until the third recycle pass is reached. At present, recycle stops at the completion of the third recycle. The material discharged from the third recycle is stored.

The extent of recycle can be controlled by specifying a fraction of available uranium for recycle. Material not thus earmarked for recycle is stored.

Plutonium Recycle

The overall control of plutonium recycle is much the same as for uranium recycle. That is, the amount of plutonium from reprocessing that is available for recycle is specified and the rest is stored. The date for the start of recycle at the reactors can also be specified.

The fissile content is determined by weighting the discharge composition of each chain in the batch by the relative amount of material in the chain. When the fissile content of the batch is established, the material is diluted with natural uranium until the input fissile concentration of the chain is reached.

The decay of ^{241}Pu to ^{241}Am occurs with a ~15-yr half-life. The fissile content of the plutonium can therefore decrease by a significant amount depending on the time elapsed from reprocessing to recycle. In determining the uranium dilution of the MOX fuel that occurs at the MOX fabrication facility, the decay of ^{241}Pu is calculated from reprocessing to the quarter (year) that it is charged into the reactor. Thus, it always arrives at the reactor with the correct fissile content.

There is no "cross fertilization" of either uranium or plutonium between BWR and PWR; BWR plutonium is recycled only in BWRs and PWR plutonium only in PWRs. This also applies to the uranium.

FUEL CYCLE COST

The total cost of each processing stage in the fuel cycle is computed using the NUCOST^(4, pp. VIII-19 and XI-8) computer code which was made into a subroutine in the ENFORM-I system.

For each Pass I scenario, the code calculates a cost report for the non-recycle case, then for the recycle case, and finally a report which shows the difference between the two cases. Every Pass I report has available both a nonrecycle and a recycle material distribution. If recycle is requested, little additional time is needed to provide a difference table which states the economic incentive for the recycle scenario specified.

The component unit cost factors are described in Table 5. The "plutonium price" is a unit price for fissile plutonium assuming that fissile plutonium is sold on a market which is external to the LWR economy. The LMFBR is the most likely external market of course. The sales of plutonium act as a negative cost which reduces the final levelized power cost.

A final levelized power cost in mills per kilowatt hour is provided at the end of each yearly cost table. The nonrecycle case is always assumed to be the base case and so its cost is subtracted from the recycle case cost in forming the difference table. This means that a negative levelized power cost in the difference table is a positive incentive for recycle.

TABLE 5. Fuel Cycle Unit Costs

<u>Item Number</u>	<u>Cost</u>	<u>Units</u>	<u>Form</u>
1	U ₃ O ₈ Charge	\$/lb	yearly schedule
2	Uranium Conversion	\$/kg-U	single value
3	Separative Work	\$/SWU	single value
4	Uranium Fabrication	\$/kg-U	single value
5	Spent Fuel Transportation	\$/kg-HM	yearly schedule
6	Spent Fuel Storage	\$/kg-HM-yr	single value
7	Reprocessing	\$/gk-HM	yearly schedule
8	Plutonium Transportation	\$/GM-Pu	single value
9	Plutonium Storage	\$/GM-Pu-yr	single value
10	Mixed Oxide Fabrication	\$/kg-HM	single value
11	Waste Disposal	\$/kg-HM	single value
12	Pu Price (negative cost) ^(a)	\$/G FISS	yearly schedule
13	Spent Fuel Disposal	\$/kg-HM	single value

(a) This assumes that there is a market external to the LWR economy which will absorb the LWR plutonium not used in LWR recycle. Sales to this market reduce LWR power costs.

IMPLEMENTATION AND CODING

The ENFORM-I system currently operates on a CDC 7600 computer under the control of a Scope 2.1 operating system. It uses a dedicated disc pack of 12 million words maximum storage capacity. A single disc pack can hold three to four complete data bases plus the required isotopics template file. The system spans a time period of 30 years. Increases in the time span will reduce proportionately the number of data base scenarios that can be stored on a disc pack. The running time for the creation of a Pass I data base is generally less than 10 minutes. Typical times for the report writer have not been established.

The subroutines in the data base generator are described briefly in the following sections. The variables are defined in Appendix C.

SUBROUTINE BOSS

Subroutine BOSS is the main program. It exerts supervisory control over the calculation and calls the other major subroutines.

SUBROUTINES FILIN, FILOUT, RDWTDS

These are the primary input-output routines that control the storage and retrieval of information on the disc pack. RDWTDS is the primary I/O routine; it does the bookkeeping on calls to FILIN and FILOUT. As the names imply, these last two routines are read-only and write-only modules.

SUBROUTINES FPP AND FX

These minor subroutines are used to calculate the decay of ^{241}Pu from discharge to the fabrication of mixed oxide fuel (FPP), and to return the change in ^{234}U and ^{236}U concentrations in the enrichment plant (FX).

SUBROUTINE IMP

IMP is the primary input reading subroutine. ENFORM-I uses NAMELIST for all input variables.

SUBROUTINE ISO

The isotopic portion of the data base is written by this subroutine using the isotopic template file and the first volume of the data base, which contains the fuel material mass distribution.

SUBROUTINE KWHR

This subroutine performs the important tasks of examining the input-installed nuclear generation capacities and allocating the generated energy to the material chains. It does this by starting up new plants based on the increases in installed capacity and by moving this capacity into the other chains as simulation time passes. Chains involving recycle are not used.

SUBROUTINES MASS, PUREC, UREC

MASS is the most important and complex subroutine. It takes the energy generation allocation produced by subroutine KWHR and calculates the mass of fuel material distributed by chain, process plant, and quarter year. The first pass determines the amount of material available for recycle. On the second pass the requested material is recycled as required and the energy is added to the recycle chains at the expense of the equilibrium chains. If there is not enough equilibrium capacity, a pool is formed and the excess is stored until the next quarter when it is added to the amount to be recycled in that quarter and another check is made against the available equilibrium chain capacity. MASS calls PUREC and UREC respectively for the detailed plutonium and uranium recycle calculations.

SUBROUTINES SEPRAT AND REPRO

These subroutines are used to determine the construction schedule for the reprocessing plants.

SUBROUTINE QA

Internal consistency checks of the input numbers are performed by the subroutine QA.

SUBROUTINE SEPWRK

This subroutine calculates the separative work performed in the enrichment plant.

SUBROUTINE SHRINK

SHRINK contracts the quarterly distributions of fuel material to a yearly distribution and writes the first "volume" of the data base.

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APPENDIX A

DATA BASE GENERATOR SAMPLE CASE

The short form of the DBG output is given here. The sequence of cases is as follows:

1. Table 1 lists the input scenario.
2. Table 2 gives the reprocessing plant schedule.
3. Table 3 gives the mass flow without recycle.
4. Table 3 gives the mass flow with recycle.
5. Section 1 repeats the mass flows from NUCOST without recycle.
6. Section 2 gives the unit cost assumptions.
7. Section 3 gives total costs without recycle for materials and services.
8. Section 4 gives the fuel cycle cost summary without recycle.
9. Sections 1 through 4 repeat items 4 through 8 above with recycle.
10. This is another repeat of sections 1 through 4 where a difference has been taken between recycle and nonrecycle. Negative costs indicate larger nonrecycle costs.

TABLE 1 INITIAL AND US NUCLEAR GENERATION CAPACITY AND CAPACITY FACTORS

CASE SCENARIO BEST CASE MODERATE LOW GROWTH SCENARIO FOR ECT PROJECT DATE: 01/20/77 TIME: 10.00.02

YEAR	BEST CASE			MODERATE			LOW GROWTH		
	CAPACITY (MW)	CAPACITY FACTOR (%)	GENERATION RATE (MW)	CAPACITY (MW)	CAPACITY FACTOR (%)	GENERATION RATE (MW)	CAPACITY (MW)	CAPACITY FACTOR (%)	GENERATION RATE (MW)
1975	28500	50.0	17500	17500	50.0	17500	40100	50.0	27000
1976	35700	70.0	24900	17500	70.0	12250	58500	70.0	37200
1977	41900	75.0	31500	18300	75.0	13500	60200	75.0	45400
1978	48300	74.0	35800	22300	74.0	15500	68600	74.0	50700
1979	53100	75.0	35700	27300	75.0	19300	69400	75.0	50500
1980	57200	72.0	33200	33200	72.0	23900	101000	72.0	72700
1981	62200	70.0	37500	42100	70.0	29400	124500	70.0	87000
1982	100500	50.0	50300	50300	50.0	50300	150000	50.0	102500
1983	117200	50.0	58600	59700	50.0	29700	174000	50.0	120200
1984	140600	57.0	80200	68300	57.0	39100	204900	57.0	154000
1985	161900	53.0	85700	77500	53.0	40700	237000	53.0	125500
1986	184300	50.0	92100	87500	50.0	43700	271500	50.0	134400
1987	209200	50.0	104500	98900	50.0	49200	306100	50.0	154500
1988	235500	50.0	117700	110500	50.0	55200	344100	50.0	174400
1989	260700	50.0	129800	124200	50.0	62000	384900	50.0	194400
1990	285000	50.0	142400	138300	50.0	69200	427500	50.0	215500
1991	315100	50.0	156100	151900	50.0	76000	470000	50.0	237400
1992	345200	50.0	170200	165800	50.0	82800	512000	50.0	259500
1993	371100	70.0	259700	179400	70.0	125500	550500	70.0	381000
1994	394300	70.0	275800	193200	70.0	135100	591500	70.0	413900
1995	420200	70.0	295200	205900	70.0	144100	630100	70.0	441000
1996	449400	70.0	314500	218500	70.0	152400	667900	70.0	467500
1997	474300	70.0	332000	231000	70.0	161700	705300	70.0	493700
1998	497500	70.0	348200	242500	70.0	169200	740100	70.0	519000
1999	514600	70.0	357200	253700	70.0	177500	773300	70.0	541500
2000	531500	50.0	375400	264500	50.0	183500	805000	50.0	565000
2001	570000	70.0	399000	270000	70.0	189000	840000	70.0	585000
2002	590000	70.0	415000	290000	70.0	203000	860000	70.0	610000
2003	520000	70.0	360000	310000	70.0	217000	840000	70.0	651000
2004	550000	70.0	380000	400000	70.0	280000	1050000	70.0	735000

INITIAL MATERIAL BACKLOG FOR US INITIAL 415000. 40

INITIAL MATERIAL BACKLOG FOR MODERATE 552500. 45

TABLE 2. REPRESENTING PLANT SCHEDULE

CASE SCENARIO: TEST CASE SCHEDULE IN DATA SCENARIO FOR EFC PROJECT									
YEAR	PLANT	YEARLY FUEL	PLANT 1	PLANT 2	PLANT 3	PLANT 4	PLANT 5	PLANT 6	PLANT 7
PLANT	ADDITION	REDACTION	OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTPUT
AT	AT	AT	AT	AT	AT	AT	AT	AT	AT
1970	1,000	0	0	0	0	0	0	0	0
1971	1,000	20	0	0	0	0	0	0	0
1972	1,000	32	0	0	0	0	0	0	0
1973	1,000	145	0	0	0	0	0	0	0
1974	1,000	203	0	0	0	0	0	0	0
1975	1,000	253	0	0	0	0	0	0	0
1976	1,000	777	0	0	0	0	0	0	0
1977	1,000	1415	0	0	0	0	0	0	0
1978	1,000	2306	0	0	0	0	0	0	0
1979	1,000	3729	500	0	0	0	0	0	0
1980	1,000	4429	1000	0	0	0	0	0	0
1981	1,000	4454	1750	0	0	0	0	0	0
1982	1,000	2205	2000	0	0	0	0	0	0
1983	1,000	2741	2250	0	0	0	0	0	0
1984	1,000	3272	2417	0	0	0	0	0	0
1985	1,000	5444	3253	0	0	0	0	0	0
1986	1,000	4239	4250	0	0	0	0	0	0
1987	1,000	5174	4717	0	0	0	0	0	0
1988	1,000	5902	5563	0	0	0	0	0	0
1989	1,000	6739	5550	0	0	0	0	0	0
1990	1,000	7555	5517	0	0	0	0	0	0
1991	1,000	8532	7553	0	0	0	0	0	0
1992	1,000	9535	8317	0	0	0	0	0	0
1993	1,000	10522	9583	0	0	0	0	0	0
1994	1,000	11472	10270	0	0	0	0	0	0
1995	1,000	12325	11349	0	0	0	0	0	0
1996	1,000	13171	12250	0	0	0	0	0	0
1997	1,000	14022	13244	0	0	0	0	0	0
1998	1,000	14872	14140	0	0	0	0	0	0
1999	1,000	15725	15067	0	0	0	0	0	0
2000	1,000	16584	15920	0	0	0	0	0	0
2001	1,000	17452	16743	0	0	0	0	0	0
2002	1,000	18355	17611	0	0	0	0	0	0
2003	1,000	19257	18445	0	0	0	0	0	0
2004	1,000	20155	19334	0	0	0	0	0	0
PLANT CAPACITY (MW/YR)									
			1500	750	2000	2000	2000	2000	2000

163. E 2 DEPTHESSING PLAT SCHEDE

[illegible]

TABLE 6. FUEL CYCLE TIME, MATERIAL FLOW, AND RECYCLE BASE DATA

CASE SCENARIO, TEST CASE, MODERATE GROWTH SCENARIO FOR ECT PROJECT										DATE: 01/07/77		TIME: 13:40:42	
YEAR	END GEN (MW)	GEN (MW)	100000 (MW)	100000 (MW)	100000 (MW)	100000 (MW)	100000 (MW)	100000 (MW)	100000 (MW)	REACTOR FUEL	SPECIAL FUEL FUEL	RECOVERED FUEL	RECYCLED FUEL
1975	210.1	9.5	17.5	12.1	4774.5	1813.	0.	0.	0.	1219.	774.	0.	0.0
1976	230.5	12.1	21.4	14.5	10255.3	2047.	0.	0.	0.	1325.	737.	0.	0.0
1977	452.3	14.9	27.0	19.7	11905.8	2453.	0.	0.	0.	1515.	1248.	0.	0.0
1978	415.0	17.0	32.5	22.5	10324.5	3003.	0.	0.	0.	1700.	1425.	0.	0.0
1979	471.0	20.2	37.2	25.4	17072.5	3757.	0.	0.	0.	1999.	1915.	0.	0.0
1980	575.1	23.4	45.5	31.1	19890.1	4422.	0.	0.	0.	2504.	1840.	0.	0.0
1981	643.7	27.0	53.5	35.1	23115.1	5101.	0.	0.	0.	3012.	2206.	0.	0.0
1982	820.2	30.6	57.5	41.5	25704.0	5451.	0.	0.	0.	3523.	2741.	0.	0.0
1983	970.5	34.5	59.4	47.1	30231.1	5753.	0.	0.	0.	4147.	3272.	0.	0.0
1984	1125.5	39.5	75.2	53.1	34125.9	7593.	0.	0.	0.	4735.	3644.	0.	0.0
1985	1321.1	42.8	81.5	59.4	40533.7	8543.	0.	0.	0.	5553.	4439.	0.	0.0
1986	1505.7	47.5	90.1	67.4	42535.6	8597.	0.	0.	0.	6281.	5174.	0.	0.0
1987	1711.2	51.4	94.2	72.8	47375.0	10574.	0.	0.	0.	7250.	5902.	0.	0.0
1988	1931.0	55.5	104.5	79.3	51651.0	11704.	0.	0.	0.	8075.	6739.	0.	0.0
1989	2143.4	59.5	117.1	85.7	56247.0	12793.	0.	0.	0.	9031.	7655.	0.	0.0
1990	2437.7	64.7	125.5	93.2	59375.0	13863.	0.	0.	0.	10045.	8542.	0.	0.0
1991	2631.5	69.5	133.4	99.5	59745.5	14633.	0.	0.	0.	10990.	9535.	0.	0.0
1992	2945.2	72.4	141.0	105.5	59775.1	15853.	0.	0.	0.	11463.	10522.	0.	0.0
1993	3237.2	75.0	145.5	111.4	72532.2	15803.	0.	0.	0.	13034.	11472.	0.	0.0
1994	3475.2	77.1	155.2	119.3	74334.7	17472.	0.	0.	0.	14053.	12525.	0.	0.0
1995	3712.5	82.1	151.0	121.7	74534.4	14532.	0.	0.	0.	14470.	13271.	0.	0.0
1996	3955.0	85.1	155.5	125.4	82550.2	19273.	0.	0.	0.	15450.	14522.	0.	0.0
1997	4145.0	90.4	175.1	142.5	85750.5	19913.	0.	0.	0.	16745.	15422.	0.	0.0
1998	4415.3	95.5	145.5	139.7	91049.2	20443.	0.	0.	0.	17554.	16505.	0.	0.0
1999	4515.5	104.7	200.7	145.5	97135.0	21753.	0.	0.	0.	19345.	17169.	0.	0.0
2000	4750.1	115.5	213.5	151.1	104751.0	25293.	0.	0.	0.	19335.	17965.	0.	0.0
2001	5025.2	125.2	222.9	177.1	114411.4	25453.	0.	0.	0.	19909.	18604.	0.	0.0
2002	5237.5	141.4	270.1	147.5	125557.5	23413.	0.	0.	0.	20584.	19365.	0.	0.0
2003	5511.1	154.1	235.5	217.5	136790.5	32577.	0.	0.	0.	22147.	20357.	0.	0.0
2004	5113.5	155.9	321.0	237.1	147710.0	37473.	0.	0.	0.	23345.	21465.	0.	0.0

1515 11th St. N. W. 1515

YEAR	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903	2904	2905	2906	2907	2908	2909	2910	2911	2912	2913	2914	2915	2916	2917	2918	2919	2920	2921	2922	2923	2924	2925	2926	2927	2928	2929	2930	2931	2932	2933	2934	2935	2936	2937	2938	2939	2940	2941	2942	2943	2944	2945	2946	2947	2948	2949	2950	2951	2952	2953	2954	2955	2956	2957	2958	2959	2960	2961	2962	2963	2964	2965	2966	2967	2968	2969	2970	2971	2972	2973	2974	2975	2976	2977	2978	2979	2980	2981	2982	2983	2984	2985	2986	2987	2988	2989	2990	2991	2992	2993	2994	2995	2996	2997	2998	2999	3000	3001	3002	3003	3004	3005	3006	3007	3008	3009	3010	3011	3012	3013	3014	3015	3016	3017	3018	3019	3020	3021	3022	3023	3024	3025	3026	3027	3028	3029	3030	3031	3032	3033	3034	3035	3036	3037	3038	3039	3040	3041	3042	3043	3044	3045	3046	3047	3048	3049	3050	3051	3052	3053	3054	3055	3056	3057	3058	3059	3060	3061	3062	3063	3064	3065	3066	3067	3068	3069	3070	3071	3072	3073	3074	3075	3076	3077	3078	3079	3080	3081	3082	3083	3084	3085	3086	3087	3088	3089	3090	3091	3092	3093	3094	3095	3096	3097	3098	3099	3100	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	3112	3113	3114	3115	3116	3117	3118	3119	3120	3121	3122	3123	3124	3125	3126	3127	3128	3129	3130	3131	3132	3133	3134	3135	3136	3137	3138	3139	3140	3141	3142	3143	3144	3145	3146	3147	3148	3149	3150	3151	3152	3153	3154	3155	3156	3157	3158	3159	3160	3161	3162	3163	3164	3165	3166	3167	3168	3169	3170	3171	3172	3173	3174	3175	3176	3177	3178	3179	3180	3181	3182	3183	3184	3185	3186	3187	3188	3189	3190	3191	3192	3193	3194	3195	3196	3197	3198	3199	3200	3201	3202	3203	3204	3205	3206	3207	3208	3209	3210	3211	3212	3213	3214	3215	3216	3217	3218	3219	3220	3221	3222	3223	3224	3225	3226	3227	3228	3229	3230	3231	3232	3233	3234	3235	3236	3237	3238	3239	3240	3241	3242	3243	3244	3245	3246	3247	3248	3249	3250	3251	3252	3253	3254	3255	3256	3257	3258	3259	3260	3261	3262	3263	3264	3265	3266	3267	3268	3269	3270	3271	3272	3273	3274	3275	3276	3277	3278	3279	3280	3281	3282	3283	3284	3285	3286	3287	3288	3289	3290	3291	3292	3293	3294	3295	3296	3297	3298	3299	3300	3301	3302	3303	3304	3305	3306	3307	3308	3309	3310	3311	3312	3313	3314	3315	3316	3317	3318	3319	3320	3321	3322	3323	3324	3325	3326	3327	3328	3329	3330	3331	3332	3333	3334	3335	3336	3337	3338	3339	3340	3341	3342	3343	3344	3345	3346	3347	3348
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SECTION 2. PROJECTED UNIT COST

YEAR	16.4	16.5	16.6	16.7	16.8	16.9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	36.9	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8	38.9	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	40.0	40.1	40.2	40.3	40.4	40.5	40.6	40.7	40.8	40.9	41.0	41.1	41.2	41.3	41.4	41.5	41.6	41.7	41.8	41.9	42.0	42.1	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	43.0	43.1	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7	44.8	44.9	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	49.0	49.1	49.2	49.3	49.4	49.5	49.6	49.7	49.8	49.9	50.0	50.1	50.2	50.3	50.4	50.5	50.6	50.7	50.8	50.9	51.0	51.1	51.2	51.3	51.4	51.5	51.6	51.7	51.8	51.9	52.0	52.1	52.2	52.3	52.4	52.5	52.6	52.7	52.8	52.9	53.0	53.1	53.2	53.3	53.4	53.5	53.6	53.7	53.8	53.9	54.0	54.1	54.2	54.3	54.4	54.5	54.6	54.7	54.8	54.9	55.0	55.1	55.2	55.3	55.4	55.5	55.6	55.7	55.8	55.9	56.0	56.1	56.2	56.3	56.4	56.5	56.6	56.7	56.8	56.9	57.0	57.1	57.2	57.3	57.4	57.5	57.6	57.7	57.8	57.9	58.0	58.1	58.2	58.3	58.4	58.5	58.6	58.7	58.8	58.9	59.0	59.1	59.2	59.3	59.4	59.5	59.6	59.7	59.8	59.9	60.0	60.1	60.2	60.3	60.4	60.5	60.6	60.7	60.8	60.9	61.0	61.1	61.2	61.3	61.4	61.5	61.6	61.7	61.8	61.9	62.0	62.1	62.2	62.3	62.4	62.5	62.6	62.7	62.8	62.9	63.0	63.1	63.2	63.3	63.4	63.5	63.6	63.7	63.8	63.9	64.0	64.1	64.2	64.3	64.4	64.5	64.6	64.7	64.8	64.9	65.0	65.1	65.2	65.3	65.4	65.5	65.6	65.7	65.8	65.9	66.0	66.1	66.2	66.3	66.4	66.5	66.6	66.7	66.8	66.9	67.0	67.1	67.2	67.3	67.4	67.5	67.6	67.7	67.8	67.9	68.0	68.1	68.2	68.3	68.4	68.5	68.6	68.7	68.8	68.9	69.0	69.1	69.2	69.3	69.4	69.5	69.6	69.7	69.8	69.9	70.0	70.1	70.2	70.3	70.4	70.5	70.6	70.7	70.8	70.9	71.0	71.1	71.2	71.3	71.4	71.5	71.6	71.7	71.8	71.9	72.0	72.1	72.2	72.3	72.4	72.5	72.6	72.7	72.8	72.9	73.0	73.1	73.2	73.3	73.4	73.5	73.6	73.7	73.8	73.9	74.0	74.1	74.2	74.3	74.4	74.5	74.6	74.7	74.8	74.9	75.0	75.1	75.2	75.3	75.4	75.5	75.6	75.7	75.8	75.9	76.0	76.1	76.2	76.3	76.4	76.5	76.6	76.7	76.8	76.9	77.0	77.1	77.2	77.3	77.4	77.5	77.6	77.7	77.8	77.9	78.0	78.1	78.2	78.3	78.4	78.5	78.6	78.7	78.8	78.9	79.0	79.1	79.2	79.3	79.4	79.5	79.6	79.7	79.8	79.9	80.0	80.1	80.2	80.3	80.4	80.5	80.6	80.7	80.8	80.9	81.0	81.1	81.2	81.3	81.4	81.5	81.6	81.7	81.8	81.9	82.0	82.1	82.2	82.3	82.4	82.5	82.6	82.7	82.8	82.9	83.0	83.1	83.2	83.3	83.4	83.5	83.6	83.7	83.8	83.9	84.0	84.1	84.2	84.3	84.4	84.5	84.6	84.7	84.8	84.9	85.0	85.1	85.2	85.3	85.4	85.5	85.6	85.7	85.8	85.9	86.0	86.1	86.2	86.3	86.4	86.5	86.6	86.7	86.8	86.9	87.0	87.1	87.2	87.3	87.4	87.5	87.6	87.7	87.8	87.9	88.0	88.1	88.2	88.3	88.4	88.5	88.6	88.7	88.8	88.9	89.0	89.1	89.2	89.3	89.4	89.5	89.6	89.7	89.8	89.9	90.0	90.1	90.2	90.3	90.4	90.5	90.6	90.7	90.8	90.9	91.0	91.1	91.2	91.3	91.4	91.5	91.6	91.7	91.8	91.9	92.0	92.1	92.2	92.3	92.4	92.5	92.6	92.7	92.8	92.9	93.0	93.1	93.2	93.3	93.4	93.5	93.6	93.7	93.8	93.9	94.0	94.1	94.2	94.3	94.4	94.5	94.6	94.7	94.8	94.9	95.0	95.1	95.2	95.3	95.4	95.5	95.6	95.7	95.8	95.9	96.0	96.1	96.2	96.3	96.4	96.5	96.6	96.7	96.8	96.9	97.0	97.1	97.2	97.3	97.4	97.5	97.6	97.7	97.8	97.9	98.0	98.1	98.2	98.3	98.4	98.5	98.6	98.7	98.8	98.9	99.0	99.1	99.2	99.3	99.4	99.5	99.6	99.7	99.8	99.9	100.0	100.1	100.2	100.3	100.4	100.5	100.6	100.7	100.8	100.9	101.0	101.1	101.2	101.3	101.4	101.5	101.6	101.7	101.8	101.9	102.0	102.1	102.2	102.3	102.4	102.5	102.6	102.7	102.8	102.9	103.0	103.1	103.2	103.3	103.4	103.5	103.6	103.7	103.8	103.9	104.0	104.1	104.2	104.3	104.4	104.5	104.6	104.7	104.8	104.9	105.0	105.1	105.2	105.3	105.4	105.5	105.6	105.7	105.8	105.9	106.0	106.1	106.2	106.3	106.4	106.5	106.6	106.7	106.8	106.9	107.0	107.1	107.2	107.3	107.4	107.5	107.6	107.7	107.8	107.9	108.0	108.1	108.2	108.3	108.4	108.5	108.6	108.7	108.8	108.9	109.0	109.1	109.2	109.3	109.4	109.5	109.6	109.7	109.8	109.9	110.0	110.1	110.2	110.3	110.4	110.5	110.6	110.7	110.8	110.9	111.0	111.1	111.2	111.3	111.4	111.5	111.6	111.7	111.8	111.9	112.0	112.1	112.2	112.3	112.4	112.5	112.6	112.7	112.8	112.9	113.0	113.1	113.2	113.3	113.4	113.5	113.6	113.7	113.8	113.9	114.0	114.1	114.2	114.3	114.4	114.5	114.6	114.7	114.8	114.9	115.0	115.1	115.2	115.3	115.4	115.5	115.6	115.7	115.8	115.9	116.0	116.1	116.2	116.3	116.4	116.5	116.6	116.7	116.8	116.9	117.0	117.1	117.2	117.3	117.4	117.5	117.6	117.7	117.8	117.9	118.0	118.1	118.2	118.3	118.4	118.5	118.6	118.7	118.8	118.9	119.0	119.1	119.2	119.3	119.4	119.5	119.6	119.7	119.8	119.9	120.0	120.1	120.2	120.3	120.4	120.5	120.6	120.7	120.8	120.9	121.0	121.1	121.2	121.3	121.4	121.5	121.6	121.7	121.8	121.9	122.0	122.1	122.2	122.3	122.4	122.5	122.6	122.7	122.8	122.9	123.0	123.1	123.2	123.3	123.4	123.5	123.6	123.7	123.8	123.9	124.0	124.1	124.2	124.3	124.4	124.5	124.6	124.7	124.8	124.9	125.0	125.1	125.2	125.3	125.4	125.5	125.6	125.7	125.8	125.9	126.0	126.1	126.2	126.3	126.4	126.5	126.6	126.7	126.8	126.9	127.0	127.1	127.2	127.3	127.4	127.5	127.6	127.7	127.8	127.9	128.0	128.1	128.2	128.3	128.4	128.5	128.6	128.7	128.8	128.9	129.0	129.1	129.2	129.3	129.4	129.5	129.6	129.7	129.8	129.9	130.0	130.1	130.2	130.3	130.4	130.5	130.6	130.7	130.8	130.9	131.0	131.1	131.2	131.3	131.4	131.5	131.6	131.7	131.8	131.9	132.0	132.1	132.2	132.3	132.4	132.5	132.6	132.7	132.8	132.9	133.0	133.1	133.2	133.3	133.4	133.5	133.6	133.7	133.8	133.9	134.0	134.1	134.2	134.3	134.4	134.5	134.6	134.7	134.8	134.9	135.0	135.1	135.2	135.3	135.4	135.5	135.6	135.7	135.8	135.9	136.0	136.1	136.2	136.3	136.4	136.5	136.6	136.7	136.8	136.9	137.0	137.1	137.2	137.3	137.4	137.5	137.6	137.7	137.8	137.9	138.0	138.1	138.2	138.3	138.4	138.5	138.6	138.7	138.8	138.9	139.0	139.1	139.2	139.3	139.4	139.5	139.6	139.7	139.8	139.9	140.0	140.1	140.2	140.3	140.4	140.5	140.6	140.7	140.8	140.9	141.0	141.1	141.2	141.3	141.4	141.5	141.6	141.7	141.8	141.9	142.0	142.1	142.2	142.3	142.4	142.5	142.6	142.7	142.8	142.9	143.0	143.1	143.2	143.3	143.4	143.5	143.6	143.7	143.8	143.9	144.0	144.1	144.2	144.3	144.4	144.5	144.6	144.7	144.8	144.9	145.0	145.1	145.2	145.3	145.4	145.5	145.6	145.7	145.8	145.9	146.0	146.1	146.2	146.3	146.4	146.5	146.6	146.7	146.8	146.9	147.0	147.1	147.2	147.3	147.4	147.5	147.6	14
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SECRETION. 201220 2153 234 4121415 40 22.165
(14 11.17) 21 1975 21.165

SECTION 1. DISCOUNTED PRESENT COSTS
(IN MILLIONS OF 1975 DOLLARS)

YEAR	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903	2904	2905	2906	2907	2908	2909	2910	2911	2912	2913	2914	2915	2916	2917	2918	2919	2920	2921	2922	2923	2924	2925	2926	2927	2928	2929	2930	2931	2932	2933	2934	2935	2936	2937	2938	2939	2940	2941	2942	2943	2944	2945	2946	2947	2948	2949	2950	2951	2952	2953	2954	2955	2956	2957	2958	2959	2960	2961	2962	2963	2964	2965	2966	2967	2968	2969	2970	2971	2972	2973	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APPENDIX B

REPORT WRITER SAMPLE CASE

A large number of reports could be generated from the data base using the report writer. The one chosen here is a complete rendering of all chemical effluents by plant. Above the column of numbers is the name of the plant. A double set of columns is printed for each chemical whose name heads the column. "MEDIUM" is the medium to which the chemical is released, i.e., air, water, or as a solid material itself. "QUALITY" refers to the basis of the release factor. A quality number is assigned on a scale of one to three with increasing reliability of the estimate.

<u>Quality</u>	<u>Basis</u>
1.0	Unsubstantiated guess
2.0	Calculated or based on laboratory measurements
3.0	Based on some plant experience

The numbers contained in the columns are merely debug numbers and do not represent actual chemical effluents.

"TEST CASE" is the name associated with the nuclear power generation scenario used in generating the data base.

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CHEMICAL ELEMENTS STREAM

VALUE NUMBER 1 TEST CASE

UNDERGROUND AVE

YEAR	URANIUM (503)	THORIUM	PLUTONIUM	SELENIUM	IODINE	YEAR
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	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	
	ANNUAL	ANNUAL	ANNUAL	ANNUAL	ANNUAL	
	CUMULATIVE	CUMULATIVE	CUMULATIVE	CUMULATIVE	CUMULATIVE	
1975	7.317E+05	7.317E+05	7.317E+05	7.317E+05	7.317E+05	1975
1976	9.332E+05	1.668E+07	9.332E+05	1.668E+07	9.332E+05	1976
1977	1.095E+07	2.756E+07	1.095E+07	2.756E+07	1.095E+07	1977
1978	1.235E+07	3.992E+07	1.235E+07	3.992E+07	1.235E+07	1978
1979	1.391E+07	5.385E+07	1.391E+07	5.385E+07	1.391E+07	1979
1980	1.565E+07	6.963E+07	1.565E+07	6.963E+07	1.565E+07	1980
1981	1.762E+07	8.793E+07	1.762E+07	8.793E+07	1.762E+07	1981
1982	2.071E+07	1.088E+08	2.071E+07	1.088E+08	2.071E+07	1982
1983	2.355E+07	1.323E+08	2.355E+07	1.323E+08	2.355E+07	1983
1984	2.615E+07	1.583E+08	2.615E+07	1.583E+08	2.615E+07	1984
1985	2.891E+07	1.871E+08	2.891E+07	1.871E+08	2.891E+07	1985
1986	3.195E+07	2.191E+08	3.195E+07	2.191E+08	3.195E+07	1986
1987	3.474E+07	2.537E+08	3.474E+07	2.537E+08	3.474E+07	1987
1988	3.740E+07	2.911E+08	3.740E+07	2.911E+08	3.740E+07	1988
1989	3.991E+07	3.311E+08	3.991E+07	3.311E+08	3.991E+07	1989
1990	4.197E+07	3.733E+08	4.197E+07	3.733E+08	4.197E+07	1990
1991	4.366E+07	4.173E+08	4.366E+07	4.173E+08	4.366E+07	1991
1992	4.508E+07	4.634E+08	4.508E+07	4.634E+08	4.508E+07	1992
1993	4.612E+07	5.115E+08	4.612E+07	5.115E+08	4.612E+07	1993
1994	4.680E+07	5.610E+08	4.680E+07	5.610E+08	4.680E+07	1994
1995	4.710E+07	6.121E+08	4.710E+07	6.121E+08	4.710E+07	1995
1996	4.705E+07	6.655E+08	4.705E+07	6.655E+08	4.705E+07	1996
1997	4.663E+07	7.217E+08	4.663E+07	7.217E+08	4.663E+07	1997
1998	4.587E+07	7.822E+08	4.587E+07	7.822E+08	4.587E+07	1998
1999	4.485E+07	8.481E+08	4.485E+07	8.481E+08	4.485E+07	1999
2000	4.355E+07	9.215E+08	4.355E+07	9.215E+08	4.355E+07	2000
2001	4.206E+07	1.004E+09	4.206E+07	1.004E+09	4.206E+07	2001
2002	4.032E+07	1.095E+09	4.032E+07	1.095E+09	4.032E+07	2002
2003	3.837E+07	1.197E+09	3.837E+07	1.197E+09	3.837E+07	2003
2004	3.626E+07	1.310E+09	3.626E+07	1.310E+09	3.626E+07	2004
AVE.	4.354E+07	4.354E+07	4.354E+07	4.354E+07	4.354E+07	
TOTAL	1.305E+09	1.305E+09	1.305E+09	1.305E+09	1.305E+09	

CHEMICALS RELEASED 43/YEAR

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VOLUME NUMBER 1 TEST CASE

SURFACE FINE

YEAR	QUANTUM (CUB)	QUANTITY 1	QUANTITY 1	QUANTITY 1	QUANTITY 1	YEAR
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ANNUAL	CUMULATIVE	ANNUAL	CUMULATIVE	ANNUAL	CUMULATIVE	
1975	7.317E+06	7.317E+06	7.317E+06	7.317E+06	7.317E+06	1975
1976	9.332E+05	1.665E+07	9.332E+05	1.665E+07	9.332E+05	1.665E+07
1977	1.095E+07	2.759E+07	1.095E+07	2.759E+07	1.095E+07	2.759E+07
1978	1.233E+07	3.992E+07	1.233E+07	3.992E+07	1.233E+07	3.992E+07
1979	1.391E+07	5.383E+07	1.391E+07	5.383E+07	1.391E+07	5.383E+07
1980	1.566E+07	6.949E+07	1.566E+07	6.949E+07	1.566E+07	6.949E+07
1981	1.762E+07	8.711E+07	1.762E+07	8.711E+07	1.762E+07	8.711E+07
1982	2.071E+07	1.078E+08	2.071E+07	1.078E+08	2.071E+07	1.078E+08
1983	2.336E+07	1.321E+08	2.336E+07	1.321E+08	2.336E+07	1.321E+08
1984	2.521E+07	1.573E+08	2.521E+07	1.573E+08	2.521E+07	1.573E+08
1985	3.145E+07	2.197E+08	3.145E+07	2.197E+08	3.145E+07	2.197E+08
1986	3.478E+07	2.545E+08	3.478E+07	2.545E+08	3.478E+07	2.545E+08
1987	3.740E+07	2.911E+08	3.740E+07	2.911E+08	3.740E+07	2.911E+08
1988	5.991E+07	3.311E+08	5.991E+07	3.311E+08	5.991E+07	3.311E+08
1989	4.192E+07	3.730E+08	4.192E+07	3.730E+08	4.192E+07	3.730E+08
1990	4.426E+07	4.173E+08	4.426E+07	4.173E+08	4.426E+07	4.173E+08
1991	4.604E+07	4.634E+08	4.604E+07	4.634E+08	4.604E+07	4.634E+08
1992	4.912E+07	5.115E+08	4.912E+07	5.115E+08	4.912E+07	5.115E+08
1993	4.930E+07	5.610E+08	4.930E+07	5.610E+08	4.930E+07	5.610E+08
1994	5.110E+07	6.121E+08	5.110E+07	6.121E+08	5.110E+07	6.121E+08
1995	5.343E+07	6.655E+08	5.343E+07	6.655E+08	5.343E+07	6.655E+08
1996	5.614E+07	7.217E+08	5.614E+07	7.217E+08	5.614E+07	7.217E+08
1997	6.047E+07	7.822E+08	6.047E+07	7.822E+08	6.047E+07	7.822E+08
1998	6.595E+07	8.481E+08	6.595E+07	8.481E+08	6.595E+07	8.481E+08
1999	7.305E+07	9.216E+08	7.305E+07	9.216E+08	7.305E+07	9.216E+08
2000	8.246E+07	1.004E+09	8.246E+07	1.004E+09	8.246E+07	1.004E+09
2001	9.192E+07	1.095E+09	9.192E+07	1.095E+09	9.192E+07	1.095E+09
2002	1.007E+08	1.197E+09	1.007E+08	1.197E+09	1.007E+08	1.197E+09
2003	1.095E+08	1.306E+09	1.095E+08	1.306E+09	1.095E+08	1.306E+09
2004	4.354E+07	1.350E+09	4.354E+07	1.350E+09	4.354E+07	1.350E+09
AVE.						
TOTAL						

CHEMICAL EFFLUENTS CONTINUED

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VOLUME UNDER TEST CASE

ACID LEACH TAIL

YEAR	QUANTUM (VOLUME) MEDIUM QUALITY 1	QUANTUM (VOLUME) MEDIUM QUALITY 1	QUANTUM (VOLUME) MEDIUM QUALITY 1	SULFATES MEDIUM QUALITY 1	QUANTUM (VOLUME) MEDIUM QUALITY 1	YEAR
-----	-----	-----	-----	-----	-----	-----
ANNUAL	CUMULATIVE	ANNUAL	CUMULATIVE	ANNUAL	CUMULATIVE	
1975	1.064E+07	1.064E+07	1.064E+07	1.351E+07	1.064E+07	1975
1976	1.319E+07	2.383E+07	1.319E+07	1.319E+07	2.383E+07	1976
1977	1.662E+07	4.045E+07	1.662E+07	1.662E+07	4.045E+07	1977
1978	1.830E+07	5.875E+07	1.830E+07	1.830E+07	5.875E+07	1978
1979	2.095E+07	7.970E+07	2.095E+07	2.095E+07	7.970E+07	1979
1980	2.371E+07	1.034E+08	2.371E+07	2.371E+07	1.034E+08	1980
1981	2.727E+07	1.307E+08	2.727E+07	2.727E+07	1.307E+08	1981
1982	3.109E+07	1.618E+08	3.109E+07	3.109E+07	1.618E+08	1982
1983	3.521E+07	1.970E+08	3.521E+07	3.521E+07	1.970E+08	1983
1984	3.970E+07	2.367E+08	3.970E+07	3.970E+07	2.367E+08	1984
1985	4.394E+07	2.807E+08	4.394E+07	4.394E+07	2.807E+08	1985
1986	4.959E+07	3.293E+08	4.959E+07	4.959E+07	3.293E+08	1986
1987	5.332E+07	3.826E+08	5.332E+07	5.332E+07	3.826E+08	1987
1988	5.786E+07	4.405E+08	5.786E+07	5.786E+07	4.405E+08	1988
1989	6.184E+07	5.023E+08	6.184E+07	6.184E+07	5.023E+08	1989
1990	6.552E+07	5.674E+08	6.552E+07	6.552E+07	5.674E+08	1990
1991	6.902E+07	6.366E+08	6.902E+07	6.902E+07	6.366E+08	1991
1992	7.225E+07	7.091E+08	7.225E+07	7.225E+07	7.091E+08	1992
1993	7.541E+07	7.845E+08	7.541E+07	7.541E+07	7.845E+08	1993
1994	7.815E+07	8.627E+08	7.815E+07	7.815E+07	8.627E+08	1994
1995	8.032E+07	9.430E+08	8.032E+07	8.032E+07	9.430E+08	1995
1996	8.352E+07	1.027E+09	8.352E+07	8.352E+07	1.027E+09	1996
1997	8.740E+07	1.114E+09	8.740E+07	8.740E+07	1.114E+09	1997
1998	9.312E+07	1.207E+09	9.312E+07	9.312E+07	1.207E+09	1998
1999	1.009E+08	1.309E+09	1.009E+08	1.009E+08	1.309E+09	1999
2000	1.111E+08	1.419E+09	1.111E+08	1.111E+08	1.419E+09	2000
2001	1.243E+08	1.543E+09	1.243E+08	1.243E+08	1.543E+09	2001
2002	1.394E+08	1.683E+09	1.394E+08	1.394E+08	1.683E+09	2002
2003	1.541E+08	1.837E+09	1.541E+08	1.541E+08	1.837E+09	2003
2004	1.643E+08	2.005E+09	1.643E+08	1.643E+08	2.005E+09	2004
Avg.	6.635E+07	6.635E+07	6.635E+07	6.635E+07	6.635E+07	
TOTAL	2.006E+09	2.006E+09	2.006E+09	2.006E+09	2.006E+09	

CHEMICAL EFFLUENTS 45/1984

VOLUME NUMBER 1 1981 CASE

ADDITIONS CONVERSION

YEAR	AMMONIUM NITRATE			METALLIC SALT			NITRIC ACID			SULFURIC ACID			YEAR
	MEDIUM	QUALITY 1		MEDIUM	QUALITY 1		MEDIUM	QUALITY 1		MEDIUM	QUALITY 1		
	ANNUAL	CUMULATIVE		ANNUAL	CUMULATIVE		ANNUAL	CUMULATIVE		ANNUAL	CUMULATIVE		
1975	1.210E+07	1.210E+07		1.210E+07	1.210E+07		1.210E+07	1.210E+07		1.210E+07	1.210E+07		1975
1976	1.463E+07	2.674E+07		1.463E+07	2.674E+07		1.463E+07	2.674E+07		1.463E+07	2.674E+07		1976
1977	1.855E+07	4.529E+07		1.855E+07	4.529E+07		1.855E+07	4.529E+07		1.855E+07	4.529E+07		1977
1978	2.197E+07	6.726E+07		2.197E+07	6.726E+07		2.197E+07	6.726E+07		2.197E+07	6.726E+07		1978
1979	2.515E+07	9.241E+07		2.515E+07	9.241E+07		2.515E+07	9.241E+07		2.515E+07	9.241E+07		1979
1980	2.874E+07	1.211E+08		2.874E+07	1.211E+08		2.874E+07	1.211E+08		2.874E+07	1.211E+08		1980
1981	3.315E+07	1.542E+08		3.315E+07	1.542E+08		3.315E+07	1.542E+08		3.315E+07	1.542E+08		1981
1982	3.831E+07	1.925E+08		3.831E+07	1.925E+08		3.831E+07	1.925E+08		3.831E+07	1.925E+08		1982
1983	4.354E+07	2.359E+08		4.354E+07	2.359E+08		4.354E+07	2.359E+08		4.354E+07	2.359E+08		1983
1984	4.902E+07	2.850E+08		4.902E+07	2.850E+08		4.902E+07	2.850E+08		4.902E+07	2.850E+08		1984
1985	5.455E+07	3.395E+08		5.455E+07	3.395E+08		5.455E+07	3.395E+08		5.455E+07	3.395E+08		1985
1986	6.075E+07	4.002E+08		6.075E+07	4.002E+08		6.075E+07	4.002E+08		6.075E+07	4.002E+08		1986
1987	6.711E+07	4.673E+08		6.711E+07	4.673E+08		6.711E+07	4.673E+08		6.711E+07	4.673E+08		1987
1988	7.359E+07	5.412E+08		7.359E+07	5.412E+08		7.359E+07	5.412E+08		7.359E+07	5.412E+08		1988
1989	7.911E+07	6.203E+08		7.911E+07	6.203E+08		7.911E+07	6.203E+08		7.911E+07	6.203E+08		1989
1990	8.469E+07	7.053E+08		8.469E+07	7.053E+08		8.469E+07	7.053E+08		8.469E+07	7.053E+08		1990
1991	9.057E+07	7.959E+08		9.057E+07	7.959E+08		9.057E+07	7.959E+08		9.057E+07	7.959E+08		1991
1992	9.684E+07	8.927E+08		9.684E+07	8.927E+08		9.684E+07	8.927E+08		9.684E+07	8.927E+08		1992
1993	9.935E+07	9.921E+08		9.935E+07	9.921E+08		9.935E+07	9.921E+08		9.935E+07	9.921E+08		1993
1994	1.040E+08	1.093E+09		1.040E+08	1.093E+09		1.040E+08	1.093E+09		1.040E+08	1.093E+09		1994
1995	1.075E+08	1.201E+09		1.075E+08	1.201E+09		1.075E+08	1.201E+09		1.075E+08	1.201E+09		1995
1996	1.114E+08	1.312E+09		1.114E+08	1.312E+09		1.114E+08	1.312E+09		1.114E+08	1.312E+09		1996
1997	1.169E+08	1.429E+09		1.169E+08	1.429E+09		1.169E+08	1.429E+09		1.169E+08	1.429E+09		1997
1998	1.229E+08	1.552E+09		1.229E+08	1.552E+09		1.229E+08	1.552E+09		1.229E+08	1.552E+09		1998
1999	1.319E+08	1.871E+09		1.319E+08	1.871E+09		1.319E+08	1.871E+09		1.319E+08	1.871E+09		1999
2000	1.432E+08	2.303E+09		1.432E+08	2.303E+09		1.432E+08	2.303E+09		1.432E+08	2.303E+09		2000
2001	1.588E+08	3.891E+09		1.588E+08	3.891E+09		1.588E+08	3.891E+09		1.588E+08	3.891E+09		2001
2002	1.775E+08	5.666E+09		1.775E+08	5.666E+09		1.775E+08	5.666E+09		1.775E+08	5.666E+09		2002
2003	1.970E+08	7.636E+09		1.970E+08	7.636E+09		1.970E+08	7.636E+09		1.970E+08	7.636E+09		2003
2004	2.150E+08	9.786E+09		2.150E+08	9.786E+09		2.150E+08	9.786E+09		2.150E+08	9.786E+09		2004
AVE.	8.585E+07			8.585E+07			8.585E+07			8.585E+07			
TOTAL	2.575E+09			2.575E+09			2.575E+09			2.575E+09			

TECHNICAL SPECIFICATIONS SUMMARY

VOLUME NUMBER 1 TEST CASE

ENVIRONMENTAL CONDITIONS

YEAR	SOLAR HYDRIDE MEDIA ANNUAL CUMULATIVE	TEMPERATURE MEDIA ANNUAL CUMULATIVE	WIND SPEED MEDIA ANNUAL CUMULATIVE	PRECIPITATION MEDIA ANNUAL CUMULATIVE	SEA LEVEL MEDIA ANNUAL CUMULATIVE	SEA LEVEL MEDIA ANNUAL CUMULATIVE
1975	1.854E+05	1.854E+05	1.854E+05	1.854E+05	1.854E+05	1.854E+05
1976	2.015E+05	2.015E+05	2.015E+05	2.015E+05	2.015E+05	2.015E+05
1977	2.571E+05	2.571E+05	2.571E+05	2.571E+05	2.571E+05	2.571E+05
1978	3.173E+05	3.173E+05	3.173E+05	3.173E+05	3.173E+05	3.173E+05
1979	3.914E+05	3.914E+05	3.914E+05	3.914E+05	3.914E+05	3.914E+05
1980	4.568E+05	4.568E+05	4.568E+05	4.568E+05	4.568E+05	4.568E+05
1981	5.253E+05	5.253E+05	5.253E+05	5.253E+05	5.253E+05	5.253E+05
1982	5.947E+05	5.947E+05	5.947E+05	5.947E+05	5.947E+05	5.947E+05
1983	6.744E+05	6.744E+05	6.744E+05	6.744E+05	6.744E+05	6.744E+05
1984	7.744E+05	7.744E+05	7.744E+05	7.744E+05	7.744E+05	7.744E+05
1985	8.771E+05	8.771E+05	8.771E+05	8.771E+05	8.771E+05	8.771E+05
1986	9.805E+05	9.805E+05	9.805E+05	9.805E+05	9.805E+05	9.805E+05
1987	1.081E+07	1.081E+07	1.081E+07	1.081E+07	1.081E+07	1.081E+07
1988	1.194E+07	1.194E+07	1.194E+07	1.194E+07	1.194E+07	1.194E+07
1989	1.302E+07	1.302E+07	1.302E+07	1.302E+07	1.302E+07	1.302E+07
1990	1.407E+07	1.407E+07	1.407E+07	1.407E+07	1.407E+07	1.407E+07
1991	1.512E+07	1.512E+07	1.512E+07	1.512E+07	1.512E+07	1.512E+07
1992	1.604E+07	1.604E+07	1.604E+07	1.604E+07	1.604E+07	1.604E+07
1993	1.695E+07	1.695E+07	1.695E+07	1.695E+07	1.695E+07	1.695E+07
1994	1.742E+07	1.742E+07	1.742E+07	1.742E+07	1.742E+07	1.742E+07
1995	1.865E+07	1.865E+07	1.865E+07	1.865E+07	1.865E+07	1.865E+07
1996	1.935E+07	1.935E+07	1.935E+07	1.935E+07	1.935E+07	1.935E+07
1997	2.005E+07	2.005E+07	2.005E+07	2.005E+07	2.005E+07	2.005E+07
1998	2.075E+07	2.075E+07	2.075E+07	2.075E+07	2.075E+07	2.075E+07
1999	2.149E+07	2.149E+07	2.149E+07	2.149E+07	2.149E+07	2.149E+07
2000	2.255E+07	2.255E+07	2.255E+07	2.255E+07	2.255E+07	2.255E+07
2001	2.349E+07	2.349E+07	2.349E+07	2.349E+07	2.349E+07	2.349E+07
2002	2.425E+07	2.425E+07	2.425E+07	2.425E+07	2.425E+07	2.425E+07
2003	3.077E+07	3.077E+07	3.077E+07	3.077E+07	3.077E+07	3.077E+07
2004	3.448E+07	3.448E+07	3.448E+07	3.448E+07	3.448E+07	3.448E+07
AVE.	1.455E+07	1.455E+07	1.455E+07	1.455E+07	1.455E+07	1.455E+07
TOTAL	4.507E+05	4.507E+05	4.507E+05	4.507E+05	4.507E+05	4.507E+05

SYNCA - FIFTEENTH 1975

SECRET

7-10-68

YEAR	AMMONIA			BURN			CALCIUM SULFIS			CARBONIDES		
	MEDIUM	QUALITY	CUMULATIVE	MEDIUM	QUALITY	CUMULATIVE	MEDIUM	QUALITY	CUMULATIVE	MEDIUM	QUALITY	CUMULATIVE
1975	1.415E+06	1.915E+06	1.415E+06	1.815E+06	1.415E+06	1.415E+06	1.915E+06	1.915E+06	1.915E+06	1.915E+06	1.915E+06	1.915E+06
1976	2.047E+06	3.555E+06	3.555E+06	2.047E+06	3.555E+06	3.555E+06	2.047E+06	3.555E+06	3.555E+06	2.047E+06	3.555E+06	3.555E+06
1977	2.454E+06	5.920E+06	5.920E+06	2.454E+06	5.920E+06	5.920E+06	2.454E+06	5.920E+06	5.920E+06	2.454E+06	5.920E+06	5.920E+06
1978	3.005E+06	9.325E+06	9.325E+06	3.005E+06	9.325E+06	9.325E+06	3.005E+06	9.325E+06	9.325E+06	3.005E+06	9.325E+06	9.325E+06
1979	3.654E+06	1.299E+07	1.299E+07	3.654E+06	1.299E+07	1.299E+07	3.654E+06	1.299E+07	1.299E+07	3.654E+06	1.299E+07	1.299E+07
1980	4.143E+06	1.713E+07	1.713E+07	4.143E+06	1.713E+07	1.713E+07	4.143E+06	1.713E+07	1.713E+07	4.143E+06	1.713E+07	1.713E+07
1981	4.727E+06	2.185E+07	2.185E+07	4.727E+06	2.185E+07	2.185E+07	4.727E+06	2.185E+07	2.185E+07	4.727E+06	2.185E+07	2.185E+07
1982	5.379E+06	2.724E+07	2.724E+07	5.379E+06	2.724E+07	2.724E+07	5.379E+06	2.724E+07	2.724E+07	5.379E+06	2.724E+07	2.724E+07
1983	6.215E+06	3.345E+07	3.345E+07	6.215E+06	3.345E+07	3.345E+07	6.215E+06	3.345E+07	3.345E+07	6.215E+06	3.345E+07	3.345E+07
1984	7.037E+06	4.049E+07	4.049E+07	7.037E+06	4.049E+07	4.049E+07	7.037E+06	4.049E+07	4.049E+07	7.037E+06	4.049E+07	4.049E+07
1985	7.917E+06	4.841E+07	4.841E+07	7.917E+06	4.841E+07	4.841E+07	7.917E+06	4.841E+07	4.841E+07	7.917E+06	4.841E+07	4.841E+07
1986	8.865E+06	5.727E+07	5.727E+07	8.865E+06	5.727E+07	5.727E+07	8.865E+06	5.727E+07	5.727E+07	8.865E+06	5.727E+07	5.727E+07
1987	9.754E+06	6.702E+07	6.702E+07	9.754E+06	6.702E+07	6.702E+07	9.754E+06	6.702E+07	6.702E+07	9.754E+06	6.702E+07	6.702E+07
1988	1.077E+07	7.730E+07	7.730E+07	1.077E+07	7.730E+07	7.730E+07	1.077E+07	7.730E+07	7.730E+07	1.077E+07	7.730E+07	7.730E+07
1989	1.175E+07	8.854E+07	8.854E+07	1.175E+07	8.854E+07	8.854E+07	1.175E+07	8.854E+07	8.854E+07	1.175E+07	8.854E+07	8.854E+07
1990	1.263E+07	1.022E+08	1.022E+08	1.263E+07	1.022E+08	1.022E+08	1.263E+07	1.022E+08	1.022E+08	1.263E+07	1.022E+08	1.022E+08
1991	1.347E+07	1.155E+08	1.155E+08	1.347E+07	1.155E+08	1.155E+08	1.347E+07	1.155E+08	1.155E+08	1.347E+07	1.155E+08	1.155E+08
1992	1.427E+07	1.299E+08	1.299E+08	1.427E+07	1.299E+08	1.299E+08	1.427E+07	1.299E+08	1.299E+08	1.427E+07	1.299E+08	1.299E+08
1993	1.503E+07	1.449E+08	1.449E+08	1.503E+07	1.449E+08	1.449E+08	1.503E+07	1.449E+08	1.449E+08	1.503E+07	1.449E+08	1.449E+08
1994	1.572E+07	1.607E+08	1.607E+08	1.572E+07	1.607E+08	1.607E+08	1.572E+07	1.607E+08	1.607E+08	1.572E+07	1.607E+08	1.607E+08
1995	1.641E+07	1.771E+08	1.771E+08	1.641E+07	1.771E+08	1.771E+08	1.641E+07	1.771E+08	1.771E+08	1.641E+07	1.771E+08	1.771E+08
1996	1.698E+07	1.941E+08	1.941E+08	1.698E+07	1.941E+08	1.941E+08	1.698E+07	1.941E+08	1.941E+08	1.698E+07	1.941E+08	1.941E+08
1997	1.745E+07	2.115E+08	2.115E+08	1.745E+07	2.115E+08	2.115E+08	1.745E+07	2.115E+08	2.115E+08	1.745E+07	2.115E+08	2.115E+08
1998	1.827E+07	2.299E+08	2.299E+08	1.827E+07	2.299E+08	2.299E+08	1.827E+07	2.299E+08	2.299E+08	1.827E+07	2.299E+08	2.299E+08
1999	1.910E+07	2.499E+08	2.499E+08	1.910E+07	2.499E+08	2.499E+08	1.910E+07	2.499E+08	2.499E+08	1.910E+07	2.499E+08	2.499E+08
2000	2.051E+07	2.799E+08	2.799E+08	2.051E+07	2.799E+08	2.799E+08	2.051E+07	2.799E+08	2.799E+08	2.051E+07	2.799E+08	2.799E+08
2001	2.249E+07	3.199E+08	3.199E+08	2.249E+07	3.199E+08	3.199E+08	2.249E+07	3.199E+08	3.199E+08	2.249E+07	3.199E+08	3.199E+08
2002	2.531E+07	3.172E+08	3.172E+08	2.531E+07	3.172E+08	3.172E+08	2.531E+07	3.172E+08	3.172E+08	2.531E+07	3.172E+08	3.172E+08
2003	2.831E+07	3.465E+08	3.465E+08	2.831E+07	3.465E+08	3.465E+08	2.831E+07	3.465E+08	3.465E+08	2.831E+07	3.465E+08	3.465E+08
2004	3.405E+07	3.505E+08	3.505E+08	3.405E+07	3.505E+08	3.505E+08	3.405E+07	3.505E+08	3.505E+08	3.405E+07	3.505E+08	3.505E+08
AVE.	1.259E+07	1.259E+07	1.259E+07	1.259E+07	1.259E+07	1.259E+07	1.259E+07	1.259E+07	1.259E+07	1.259E+07	1.259E+07	1.259E+07
TOTAL	3.809E+09	3.809E+09	3.809E+09	3.809E+09	3.809E+09	3.809E+09	3.809E+09	3.809E+09	3.809E+09	3.809E+09	3.809E+09	3.809E+09

THE NATIONAL BUREAU OF STANDARDS

WATER QUALITY DATA - 1975

WATER QUALITY DATA

YEAR	ANNUAL		MONTHLY		TOTAL		TOTAL		YEAR
	MEAN	MAX	MEAN	MAX	MEAN	MAX	MEAN	MAX	
1975	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1975
1976	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1976
1977	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1977
1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1978
1979	1.037E+05	1.037E+05	1.037E+05	1.037E+05	1.037E+05	1.037E+05	1.037E+05	1.037E+05	1979
1980	2.797E+05	3.530E+05	2.797E+05	3.530E+05	2.797E+05	3.530E+05	2.797E+05	3.530E+05	1980
1981	5.735E+05	7.570E+05	5.735E+05	7.570E+05	5.735E+05	7.570E+05	5.735E+05	7.570E+05	1981
1982	4.725E+05	1.229E+06	4.725E+05	1.229E+06	4.725E+05	1.229E+06	4.725E+05	1.229E+06	1982
1983	5.406E+05	1.774E+06	5.406E+05	1.774E+06	5.406E+05	1.774E+06	5.406E+05	1.774E+06	1983
1984	5.622E+05	2.338E+06	5.622E+05	2.338E+06	5.622E+05	2.338E+06	5.622E+05	2.338E+06	1984
1985	5.264E+05	2.753E+06	5.264E+05	2.753E+06	5.264E+05	2.753E+06	5.264E+05	2.753E+06	1985
1986	7.514E+05	3.574E+06	7.514E+05	3.574E+06	7.514E+05	3.574E+06	7.514E+05	3.574E+06	1986
1987	9.205E+05	4.515E+06	9.205E+05	4.515E+06	9.205E+05	4.515E+06	9.205E+05	4.515E+06	1987
1988	4.531E+05	5.446E+06	4.531E+05	5.446E+06	4.531E+05	5.446E+06	4.531E+05	5.446E+06	1988
1989	1.034E+06	6.501E+06	1.034E+06	6.501E+06	1.034E+06	6.501E+06	1.034E+06	6.501E+06	1989
1990	1.229E+05	7.750E+06	1.229E+05	7.750E+06	1.229E+05	7.750E+06	1.229E+05	7.750E+06	1990
1991	1.413E+05	9.149E+06	1.413E+05	9.149E+06	1.413E+05	9.149E+06	1.413E+05	9.149E+06	1991
1992	1.594E+05	1.075E+07	1.594E+05	1.075E+07	1.594E+05	1.075E+07	1.594E+05	1.075E+07	1992
1993	1.775E+05	1.252E+07	1.775E+05	1.252E+07	1.775E+05	1.252E+07	1.775E+05	1.252E+07	1993
1994	1.904E+05	1.405E+07	1.904E+05	1.405E+07	1.904E+05	1.405E+07	1.904E+05	1.405E+07	1994
1995	2.125E+05	1.559E+07	2.125E+05	1.559E+07	2.125E+05	1.559E+07	2.125E+05	1.559E+07	1995
1996	2.299E+05	1.740E+07	2.299E+05	1.740E+07	2.299E+05	1.740E+07	2.299E+05	1.740E+07	1996
1997	2.452E+05	1.955E+07	2.452E+05	1.955E+07	2.452E+05	1.955E+07	2.452E+05	1.955E+07	1997
1998	2.590E+05	2.192E+07	2.590E+05	2.192E+07	2.590E+05	2.192E+07	2.590E+05	2.192E+07	1998
1999	2.673E+05	2.509E+07	2.673E+05	2.509E+07	2.673E+05	2.509E+07	2.673E+05	2.509E+07	1999
2000	2.760E+05	2.837E+07	2.760E+05	2.837E+07	2.760E+05	2.837E+07	2.760E+05	2.837E+07	2000
2001	2.902E+05	3.251E+07	2.902E+05	3.251E+07	2.902E+05	3.251E+07	2.902E+05	3.251E+07	2001
2002	3.104E+05	3.542E+07	3.104E+05	3.542E+07	3.104E+05	3.542E+07	3.104E+05	3.542E+07	2002
2003	3.261E+05	3.855E+07	3.261E+05	3.855E+07	3.261E+05	3.855E+07	3.261E+05	3.855E+07	2003
2004	3.425E+05	4.210E+07	3.425E+05	4.210E+07	3.425E+05	4.210E+07	3.425E+05	4.210E+07	2004
AVE.	1.403E+06		1.403E+06		1.403E+06		1.403E+06		
TOTAL	4.210E+07		4.210E+07		4.210E+07		4.210E+07		

[illegible]

CHEMICAL EFFLUENTS 45/YEAR

VALUE NUMBER 1 1991 CASE

REPROCESSING

YEAR	AMMONIA MEDIUM	QUALITY 1 ANNUAL CUMULATIVE	CALCIUM SALTS MEDIUM	QUALITY 1 ANNUAL CUMULATIVE	CALCIUM MEDIUM	QUALITY 1 ANNUAL CUMULATIVE	CHLORIDES MEDIUM	QUALITY 1 ANNUAL CUMULATIVE	YEAR
1975	0.	0.	0.	0.	0.	0.	0.	0.	1975
1976	0.	0.	0.	0.	0.	0.	0.	0.	1976
1977	0.	0.	0.	0.	0.	0.	0.	0.	1977
1978	5.000E+05	5.000E+05	5.000E+05	5.000E+05	5.000E+05	5.000E+05	5.000E+05	5.000E+05	1978
1979	1.000E+05	1.500E+05	1.000E+05	1.500E+05	1.000E+05	1.500E+05	1.000E+05	1.500E+05	1979
1980	1.750E+05	3.250E+05	1.750E+05	3.250E+05	1.750E+05	3.250E+05	1.750E+05	3.250E+05	1980
1981	2.250E+05	5.500E+05	2.250E+05	5.500E+05	2.250E+05	5.500E+05	2.250E+05	5.500E+05	1981
1982	2.750E+05	8.250E+05	2.750E+05	8.250E+05	2.750E+05	8.250E+05	2.750E+05	8.250E+05	1982
1983	3.000E+05	1.125E+07	3.000E+05	1.125E+07	3.000E+05	1.125E+07	3.000E+05	1.125E+07	1983
1984	3.000E+05	1.425E+07	3.000E+05	1.425E+07	3.000E+05	1.425E+07	3.000E+05	1.425E+07	1984
1985	3.557E+05	1.792E+07	3.557E+05	1.792E+07	3.557E+05	1.792E+07	3.557E+05	1.792E+07	1985
1986	4.334E+05	2.225E+07	4.334E+05	2.225E+07	4.334E+05	2.225E+07	4.334E+05	2.225E+07	1986
1987	5.001E+05	2.725E+07	5.001E+05	2.725E+07	5.001E+05	2.725E+07	5.001E+05	2.725E+07	1987
1988	5.658E+05	3.292E+07	5.658E+05	3.292E+07	5.658E+05	3.292E+07	5.658E+05	3.292E+07	1988
1989	5.335E+05	3.925E+07	5.335E+05	3.925E+07	5.335E+05	3.925E+07	5.335E+05	3.925E+07	1989
1990	7.658E+05	4.592E+07	7.658E+05	4.592E+07	7.658E+05	4.592E+07	7.658E+05	4.592E+07	1990
1991	9.335E+05	5.525E+07	9.335E+05	5.525E+07	9.335E+05	5.525E+07	9.335E+05	5.525E+07	1991
1992	9.554E+05	6.492E+07	9.554E+05	6.492E+07	9.554E+05	6.492E+07	9.554E+05	6.492E+07	1992
1993	1.034E+07	7.525E+07	1.034E+07	7.525E+07	1.034E+07	7.525E+07	1.034E+07	7.525E+07	1993
1994	1.157E+07	8.595E+07	1.157E+07	8.595E+07	1.157E+07	8.595E+07	1.157E+07	8.595E+07	1994
1995	1.234E+07	9.925E+07	1.234E+07	9.925E+07	1.234E+07	9.925E+07	1.234E+07	9.925E+07	1995
1996	1.357E+07	1.129E+08	1.357E+07	1.129E+08	1.357E+07	1.129E+08	1.357E+07	1.129E+08	1996
1997	1.434E+07	1.273E+08	1.434E+07	1.273E+08	1.434E+07	1.273E+08	1.434E+07	1.273E+08	1997
1998	1.500E+07	1.425E+08	1.500E+07	1.425E+08	1.500E+07	1.425E+08	1.500E+07	1.425E+08	1998
1999	1.557E+07	1.579E+08	1.557E+07	1.579E+08	1.557E+07	1.579E+08	1.557E+07	1.579E+08	1999
2000	1.634E+07	1.743E+08	1.634E+07	1.743E+08	1.634E+07	1.743E+08	1.634E+07	1.743E+08	2000
2001	1.767E+07	1.920E+08	1.767E+07	1.920E+08	1.767E+07	1.920E+08	1.767E+07	1.920E+08	2001
2002	1.834E+07	2.103E+08	1.834E+07	2.103E+08	1.834E+07	2.103E+08	1.834E+07	2.103E+08	2002
2003	1.957E+07	2.300E+08	1.957E+07	2.300E+08	1.957E+07	2.300E+08	1.957E+07	2.300E+08	2003
2004	2.034E+07	2.503E+08	2.034E+07	2.503E+08	2.034E+07	2.503E+08	2.034E+07	2.503E+08	2004
AVE.	5.344E+05		5.344E+05		5.344E+05		5.344E+05		
TOTAL	2.503E+08		2.503E+08		2.503E+08		2.503E+08		

APPENDIX C

DEFINITIONS OF VARIABLES

The names and brief descriptions of the variables used in ENFORM-I are catalogued here. Just the briefest description is included in this appendix which is the group of comment cards used in the main subroutine BOSS.

125	CUMMS	VERBAL
126	VERBAL	VERBAL
127	VERBAL	VERBAL
128	VERBAL	VERBAL
129	VERBAL	VERBAL
130	VERBAL	VERBAL
131	VERBAL	VERBAL
132	VERBAL	VERBAL
133	VERBAL	VERBAL
134	VERBAL	VERBAL
135	VERBAL	VERBAL
136	VERBAL	VERBAL
137	VERBAL	VERBAL
138	VERBAL	VERBAL
139	VERBAL	VERBAL
140	VERBAL	VERBAL
141	VERBAL	VERBAL
142	VERBAL	VERBAL
143	VERBAL	VERBAL
144	VERBAL	VERBAL
145	VERBAL	VERBAL
146	VERBAL	VERBAL
147	VERBAL	VERBAL
148	VERBAL	VERBAL
149	VERBAL	VERBAL
150	VERBAL	VERBAL
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174	VERBAL	VERBAL
175	VERBAL	VERBAL
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177	VERBAL	VERBAL
178	VERBAL	VERBAL
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191	VERBAL	VERBAL
192	VERBAL	VERBAL
193	VERBAL	VERBAL
194	VERBAL	VERBAL
195	VERBAL	VERBAL
196	VERBAL	VERBAL
197	VERBAL	VERBAL
198	VERBAL	VERBAL
199	VERBAL	VERBAL
200	VERBAL	VERBAL

230	IVRJR	FIRST YEAR PLUTONIUM RECYC(CAL.YEAR)	VERBAL	88
			VERBAL	89
			VERBAL	90
	NAMEY(CHAIN TYPE)	NAMES OF REACTOR CHAIN TYPES (BOSS)	VERBAL	91
			VERBAL	92
235	ENSD(FUEL TYPE)	ENERGY MASS DEFECT (MIN/MAX)	VERBAL	93
			VERBAL	94
	PNVM(MODU.2)	PROCESS NAMES (BOSS)	VERBAL	95
			VERBAL	96
	PNVM(FIL DIMENSION)	PROCESS RECORD NAME (VARIABLE)	VERBAL	97
			VERBAL	98
240	CHVM(FIL DIMENSION)	CHAIN RECORD NAME (VARIABLE)	VERBAL	99
			VERBAL	100
	BLNK	BLANK WORD (CONSTANT)	VERBAL	101
			VERBAL	102
245	ELTRN(QUARTER,CHAIN)	ELECTRIC ENERGY GENERATION (MWDE)	VERBAL	103
			VERBAL	104
	IERH	2A ERROR FLAG 1 CASE ABORTED (QA)	VERBAL	105
			VERBAL	106
	IPC	CHAIN INDEX (BOSS)	VERBAL	107
			VERBAL	108
250	IPCX	MAXIMUM CHAIN INDEX (BOSS)	VERBAL	109
			VERBAL	110
	IPNX	MAXIMUM MODULE INDEX (BOSS)	VERBAL	111
			VERBAL	112
255	IRX	CHAIN TYPE INDEX (BOSS)	VERBAL	113
			VERBAL	114
	IRXX	REACTOR TYPE MAXIMUM (BOSS)	VERBAL	115
			VERBAL	116
	IRXR	MAXIMUM ALLOWABLE RECYCLES (BOSS)	VERBAL	117
			VERBAL	118
260	IRXM	MAXIMUM CHAIN TYPES (BOSS)	VERBAL	119
			VERBAL	120
	ITS	MAXIMUM QUARTERS (BOSS)	VERBAL	121
			VERBAL	122
265	ITMAX	MAXIMUM EXTENDED QUARTERS (BOSS)	VERBAL	123
			VERBAL	124
	ITY	MAXIMUM YEARS (BOSS)	VERBAL	125
			VERBAL	126
270	ITRU	TRANSPORTATION TIME J RECYC(QUARTERS)	VERBAL	127
			VERBAL	128
	ITRP	TRANSPORTATION TIME 20 RECYC(QUARTERS)	VERBAL	129
			VERBAL	130
	INTER	INITIAL CLEAR INDEX (SUB MASS)	VERBAL	131
			VERBAL	132
275	IRCYCL	NO. OF RECYCLES/VARIABLES CLEAR(BOSS)	VERBAL	133
			VERBAL	134
	ITM	MAXIMUM MINE TYPES (BOSS)	VERBAL	135
			VERBAL	136
	ITEMP	SCRATCH DISK FILE UNIT (BOSS)	VERBAL	137
			VERBAL	138
280	MDVOLS	MODULE VOLUME DISK UNIT (BOSS)	VERBAL	139
			VERBAL	140
	PDJL(AS NEEDED)	SCRATCH EQUIVALENCE	VERBAL	141
			VERBAL	142
285	MDJOL(EXT QUARTERS,CHAIN)	TEMPORARY QRT URANIUM POOL (KG-M)	VERBAL	143
		EQUIVALENCE TO	VERBAL	144


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C      ECHO(MJRD5/CARD)      VERBAL 202
C      TITLE(MJRD5/CARD)     VERBAL 203
C      INPUT TEMP STORAGE AND PRINT ARRAY  VERBAL 204
C      TEMP STORAGE FOR TITLE ARRAY  VERBAL 205
C      VERBAL 206
C      VERBAL 207
C      VERBAL 208

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