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The Molten-Salt Reactor Information System

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MASTER



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Reactor Division

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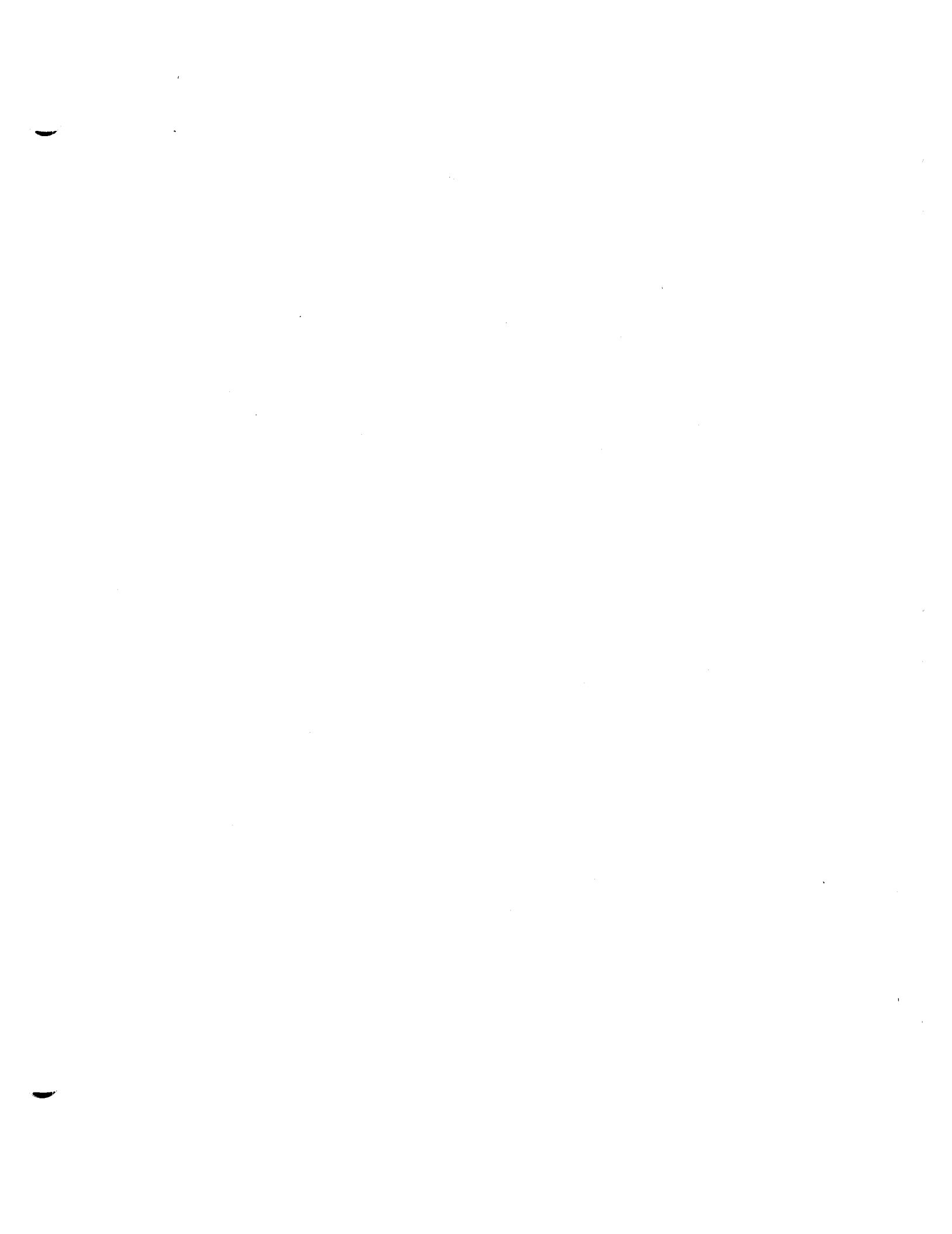
JUNE 1975

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THE MOLTEN-SALT REACTOR INFORMATION SYSTEM

P. N. Haubenreich
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Abstract

The Molten-Salt Reactor Information System (MSRIS) is a computer-based file of abstracts of documents dealing with the technology of molten-salt reactors. The file is stored in the IBM-360 system at ORNL, and may be searched through the use of established interactive computer programs from remote terminals connected to the computer via telephone lines. The system currently contains 373 entries and is subject to updating and expansion as additional information is developed.

This document describes the nature and general content of the data file, a general approach for obtaining information from it, and the manner in which material is added to the file. Appendixes provide the list of keywords currently in use, the subject categories under which information is filed, and simplified procedures for searching the file from remote terminals.

1. INTRODUCTION

Nuclear reactors in which the fissile and fertile materials are incorporated in molten-salt mixtures offer a route to long-term, economical power that is both promising and distinctly different from other reactors now being built and developed. Molten-salt reactor technology is not new, having its beginnings in the aircraft reactor program in 1947. Thus, there exists a considerable store of information which has been built up over the years.¹ During most of this time, a formal system for information retrieval was unnecessary, because the preponderance of the work on MSR technology was done at one site (the Oak Ridge National Laboratory), within a closely knit project organization. As other organizations began to participate in this activity a need was created that the MSRIS was designed to meet.

The MSRIS is intended to contain an up-to-date and readily accessible file of abstracts of selected documents dealing with all aspects of molten-salt reactor technology. The purpose is to help searchers find the information they seek by quickly identifying the documents that contain the desired information and by displaying brief abstracts so the searchers can decide which documents they need to read. The abstracts are stored in the IBM-360 computer system at ORNL and various remote terminals can be used for search instructions and output.*

The original data file was established over a period of time in 1971 and 1972 from information that was then available; an indexed compilation² of the first 321 entries was published in 1971. Subsequent additions raised the total number of entries to 373. This work was stopped when the entire MSR program was discontinued early in 1973. With the reactivation of the program (in 1974), the MSRIS was restored to its prior condition. It is anticipated that the data file will be gradually updated and then kept current as this program continues.

The sections which follow describe the kinds of documents and information that are included in the MSRIS, general procedures for retrieving information, and how the abstracts are prepared and indexed. Appendixes provide the list of keywords, the subject categories, and detailed computer procedures.

2. DOCUMENTS AND INFORMATION STORED IN MSRIS

The kinds of documents included in the MSRIS are all those that are generally available to the public. This includes ORNL reports (ORNL-xxxx) and technical memoranda (ORNL-TM-xxxx) and similar reports from other sites. Letters and internal correspondence (even though assigned an MSR memo number) are not included. No ORNL-CF memo is included unless it contains information of wide interest which is not otherwise available. (There are some older ORNL-CF memos like this; if a forthcoming ORNL-CF memo seems to fit this description, consideration should be given to putting out the information in a more accessible form.) Books, journal

*The MSRIS file is one of several "data bases" on different subjects stored in the computer, all with consistent format and searchable by the same programs and terminals.

articles, papers given at meetings for which reprints were made available; all are subject to inclusion in MSRIS.

Although its spectrum of documents is quite broad, the MSRIS is by no means intended to include every single document published on molten salts or even on molten-salt reactors.* Selection of documents from among those published prior to 1971 was by a panel of experts from all parts of the molten-salt reactor program at ORNL. The criterion was that the chosen documents give an adequate description of all significant developments at least as far back as the initiation of the MSRE design in 1960. All externally available documents originating in the molten-salt reactor program at ORNL since 1970 are to be routinely abstracted by the authors and then filed in the MSRIS. The staff of the MSRIS (all part-time) may also abstract significant public documents originating elsewhere and add them to the MSRIS file.

The information that is stored in MSRIS for each document is illustrated by Fig. 1 which is a reproduction of a complete entry for one report as it was retrieved from the file. Numbers have been added to identify the seven information fields that are actually used in MSRIS and to provide a key to the description of these fields below. It may be noted that three additional labels - <AUTHSHIP>, <REFERENC>, and <KEYTERMS> - appear on the illustration; these identify groups, or subsets, of information fields. Use of one of these expressions (or its abbreviation) causes the computer to deal with all of the information fields in that subset.

1. <HEADER >: This field provides an explicit identification for every document or entry in the file, as well as some very general information about the document itself. The first three characters (alphabetic) define the primary category** into which the material contained in the document falls. This is the category which best describes the main thrust of the document, the greatest proportion of its content, or the purpose

* Information on all kinds of molten salts (most of which are not suitable for use in molten-salt reactors) is embraced in the Molten Salt Data Center of Rensselaer Polytechnic Institute.

** The MSRIS category system is described later, in connection with retrieval of information, and a complete listing of all categories is provided in Appendix B.

321 ####
1 <HEADER >MCD700019
<AUTHSHIP>
2 <AUTHOR >Engel, J.R.; Haubenreich, P.N.; Houtzeel, A.
3 <TITLE >SPRAY, MIST, BUBBLES, AND FOAM IN THE MOLTEN-SALT REACTOR EXPERIMENT
<REFERENC>
4 <PUB DESC>Oak Ridge National Laboratory, Tenn. ORNL-TM-3027 (June 1970), 102 p,
33 fig, 65 ref.
<KEYTERMS>
5 <SUBJ CAT>MCD ; MDB; KAB
6 <KEYWORDS>*analysis; *experience; * MSRE; *operation; beryllium ; bubbles;
corrosion products; density; foaming ; gas injection; interfacial tension ;
liquid level measurement; mists; off-gas systems ; physical properties; pumps;
sprays; void fractions ; primary system
7 <ABSTRACT>In the fuel pump bowl 50 gpm of salt was sprayed through the cover gas
and into the salt pool. Effects included not only the intended xenon stripping
but several others which became the subject of investigations reported here.
The spray produced a mist of salt droplets, some of which drifted into the
off-gas line at a rate of a few grams per month. The resultant salt deposits
required cleanout at intervals of six months to a year. The stripper jets also
drove bubbles several inches into the salt pool, reducing the average density
and raising the actual level above that indicated by the bubbler level elements.
Some salt transferred into the overflow line, apparently as froth although
there was no evidence of persistent foam. Most of the bubbles driven into the
salt returned to the surface, but a small fraction was drawn into the
circulating loop. The situation was such that small changes in pump speed or
physical properties of the salt changed the depth of the bubble zone enough to
change the volume fraction of gas in the loop over the range from 0.02% to 0.7%.

Fig. 1. Example of MSRIS entry.

for which it was written. Since the content of a document frequently does not fit completely into any one category, other categories may be listed elsewhere in the entry (see below). The remainder of the header consists of a 6-digit number that identifies the entry. The first two digits identify the year of publication and the last four are assigned serially to entries of that year as they are added to the MSRIS file. Topical reports normally are treated in only one entry; however, reports covering a variety of subjects, such as MSRP semiannual progress reports, may have an entry for each of the several subjects covered. In such cases the header for each entry has both a different primary category and a different identifying number. In addition to the header identification, each individual entry is assigned a simple sequential number (beginning with 1) to identify its position in the data file. Thus, the document used in the example for Fig. 1 is number 321 in the data set.

2. <AUTHOR >: The "author" field is one of several fields in a subset that carries the generic title of "authorship" or, in computer terminology, <AUTHSHIP>. Since author is the only member of this subset used in MSRIS, either designation could be used. This field contains the names of all authors, where they are explicitly identified. Where individual authors are not identified, as in the case of MSRP semiannual progress reports, the expression "(Staff Report)" is entered in the author field.

3. <TITLE >: This is a unique field label, and the field contains the full title of the document as it appears on the published version. Section titles are used along with the document title for progress reports.

4. <PUB DESC>: The "publication description" is a member of the subset of fields containing reference information, <REFERENC>. Again, only one member of the subset is used in MSRIS. This field contains the name of the organization that originated the document, the document number, its publication date, and some indication of its size and breadth of scope (numbers of pages, figures, and references).

5. <SUBJ CAT>: The "subject category" is one of two fields used in MSRIS out of the subset generically identified as <KEYTERMS>. This field contains, first, the primary category (from the "header"), and then any other categories to which the document may have been assigned.

6. <KEYWORDS>: This field is the other member of the "keyterms" that appear in the file. The most important, or most relevant, keywords appear at the beginning of the field, and each is preceded by an asterisk (*). All of the keywords that appear in the file were selected from the list given in Appendix A; however, some of the keywords in that list may not yet have been used. The list is subject to revision as the information file expands.

7. <ABSTRACT>: This field contains the text of the document abstract. Often it is the same abstract that appears at the beginning of the document itself, but this is not a requirement.

3. SEARCHING THE DATA FILE

The MSRIS file is stored in the memory of the IBM-360 computer system at the Oak Ridge National Laboratory. Also stored there are the programs that are needed for searching the file. Wide access is provided through various kinds of remote terminals, including Teletype, IBM-2741, and NOVAR terminals, which can be connected through the telephone system to ORNL's IBM-360/75. The file may be used freely by ORNL staff members and outside organizations who have access to the ORNL computing facilities.

The MSRIS file is only one of many (32 at the present time) in the ORNL computer that can be searched by the ORLOOK program.³ This program was designed to be quite versatile, providing many options for searching these files, and, in fact, is so versatile that learning to exercise all of its potential would require considerable time. We believe, however, that the needs of most users of the MSRIS will be satisfied by a few options that are relatively simple to learn to use. A discussion of the equipment and programs and step-by-step procedures for using them with MSRIS are given in Appnedix C. Additional details may be found in Ref. 3. That which follows is a discussion of the basic logic and general procedures that are involved.

If one wishes to sift the file to find all records on a chosen subject, the best way is by subject category, by keywords, or by some

combination of the two. Of course, if one is looking for a specific reference and has some clue, such as the name of one of the author or the report number, these can be used to narrow and speed his search.

Searching by Keywords

The current list of keywords for MSRIS is given in Appendix A. A few have not yet been used and so do not appear as keywords in the computer file. Others may appear in many separate records. (The ORLOOK program refers to the filed material for each document as a "record".) At the moment there are 373 records in the MSRIS file.

A searcher could select one keyword that most nearly identifies the subject in which he is interested, and look at all records having that keyword. But usually a single keyword fetches more records than a person may have time to examine. So one narrows the search by specifying more than one keyword. There is more than one way to go about this. One could start by selecting a set of several keywords that he feels should define precisely what he is interested in, and retrieve only those records that include among their keywords all those in the specified set. The other way would be to narrow the file in stages; first to those records having the one or two most important keywords; then, from among these, the records having the next most significant keyword; and so on. Finally, the file would either be narrowed to the specific subject of interest or contain so few records that the searcher could afford to have them all displayed for his examination. (The conversational program tells the searcher how many records he is dealing with at each stage in his search.) The first way is quicker, but runs the risk of omitting some records that may be of interest, but might not have been given every one of the keywords in the searcher's set. (When searching one should remember the human element; that is, that the person who assigned keywords to the document inevitably viewed it from a standpoint different from that of the searcher.)

Sometimes it may prove useful to use the option of discriminating against documents having some keyword or other feature. For example, it may be desirable to examine all pertinent records other than progress reports. This procedure is also explained in Appendix C.

Subject Categories

The subject category system is like a set of 14 large file boxes, each containing several smaller boxes in which the records are stored.* The 14 large boxes correspond to the 14 broad areas or first-order categories listed in Table 1. As shown in Appendix B, all but two (D and N) are further subdivided.

Table 1. MSRIS first-order categories

Category	Subject
A	Molten-salt reactor programs
B	Reactor analysis
C	Reactor chemistry
D	Analytical chemistry
E	Graphite
F	Hastelloy N and related alloys
G	Materials other than Hastelloy N and graphite
H	Reactor component development
I	Reactor design
J	Instrumentation and controls
K	Operation and maintenance
L	Fuel preparation and processing
M	MSRE
N	Miscellaneous

The way the subject category system works is illustrated in Fig. 2, which is a schematic representation of a portion of the category M file. The outer box encompasses all documents dealing to any significant extent with any aspect of the MSRE. A document that is essentially a review of all aspects of the MSRE would be tagged with the designation MXX and be put into a box with all other comprehensive documents having this tag.**

* It may be noted that, in effect, duplicate copies of records may be stored in more than one box, since many records are assigned both a primary category and other categories.

** Either as the primary category in the header of the computer record or as an "other category" in the subject category field.

M. MSRE

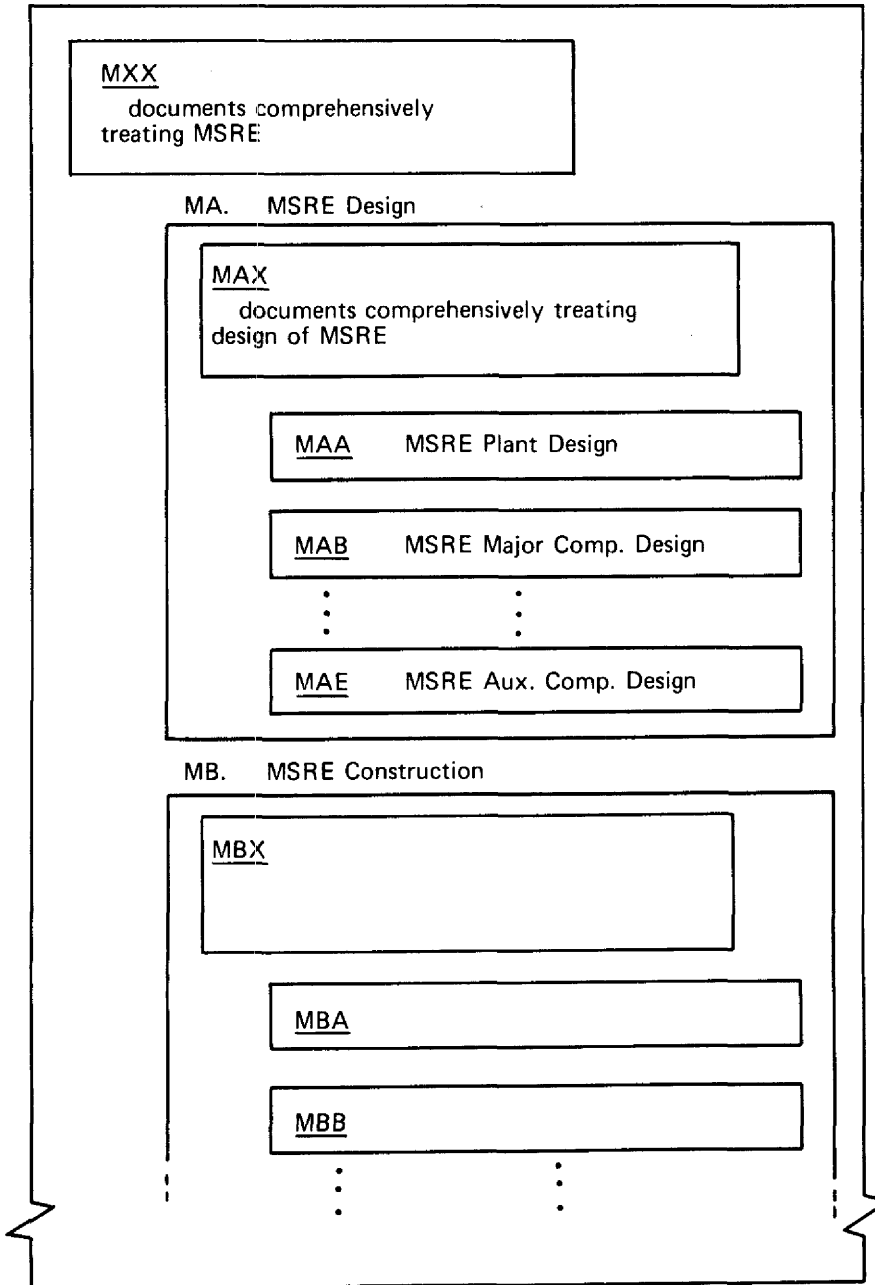


Fig. 2. Schematic representation of a portion of the MSRIS category system of filing.

Documents dealing with MSRE design go into box MA. Those covering design of many or all parts of the MSRE are tagged MAX and go into the box so designated. Documents dealing only with the design of specific parts of the MSRE are tagged MAA, MAB, etc., as appropriate, and go into separate boxes. Documents on MSRE construction, operation, etc., are similarly sorted.

4. PREPARATION OF INFORMATION FOR MSRIS

For each document that is to be included in MSRIS, the required information is assembled in the form shown in Fig. 3. The material is, in many respects, the same as that discussed earlier in the description of a representative entry, but it has been rearranged to facilitate its preparation. Whenever possible, this information is supplied to the MSRIS staff by one of the authors when the document is published. Preparation of the computer entry and insertion into the data file then follow routinely. The following discussion of the information items is keyed to the numbers beside the example in Fig. 3.

1. Authors: List all authors, last names first, initials, no punctuation except +.
2. Title: Give the complete title as on the published document.
3. Originating organization: Use a brief form of the name, but do not abbreviate to the point of being cryptic; for ORNL, use the form shown.
4. Reference information: Generally this includes document identification, date of publication, and number of pages, figures and references. Formats for various kinds of documents are illustrated below.
5. Abstract: Guidelines for abstracting are given below.
6. Keywords: These are to be selected from the MSRIS Keyword List in Appendix A.
7. Proposed keywords: If an author or abstracter feels that a keyword is needed which is not in the MSRIS Keyword List, he should list it on a separate line for consideration when the list is next revised.

Key to text	Example
1	Engel JR + Haubenreich PN + Houtzeel A
2	SPRAY, MIST, BUBBLES, AND FOAM IN THE MOLTEN-SALT REACTOR EXPERIMENT
3	Oak Ridge National Laboratory, Tenn.
4	ORNL-TM-3027 (June 1970), 102 p, 33 fig, 65 ref.
5	In the fuel pump bowl 50 gpm of salt was sprayed through the cover gas and into the salt pool. Effects included not only the intended xenon stripping but several others which became the subject of investigations reported here. The spray produced a mist of salt droplets, some of which drifted into the offgas line at a rate of a few grams per month. The resultant salt deposits required cleanout at intervals of six months to a year. The stripper jets also drove bubbles several inches into the salt pool, reducing the average density and raising the actual level above that indicated by the bubbler level elements. Some salt transferred into the overflow line, apparently as froth although there was no evidence of persistent foam. Most of the bubbles driven into the salt returned to the surface, but a small fraction was drawn into the circulating loop. The situation was such that small changes in pump speed or physical properties of the salt changed the depth of the bubble zone enough to change the volume fraction of gas in the loop over the range from 0.02% to 0.7%.
6	*analysis + *experience + *MSRE + *operation + beryllium + bubbles + corrosion products + density + foaming + fused salts + gas injection + interfacial tension + liquid level measurement + mists + off-gas systems + physical properties + pumps + sprays + void fractions + primary systems
7	overflow

Fig. 3. Example of form in which abstracts are submitted for the molten-salt reactor information system.

Format for Reference Information

The "reference" line (item 4 in Fig. 3) not only gives the information needed to locate or to order the document, but also gives clues as to how "meaty" it is (how many pages, figures, and references are included). Examples of reference lines for various kinds of documents follow:

USAEC report

ORNL-4233 (Feb. 1968), 60 p, 24 fig, 25 ref.

Other reports

AECL-3293 (Mar. 1969), 30 p, 15 fig, 18 ref.

US Govt. Printing Office (Jan. 1970), 138 p, 59 fig, 23 ref.

Edison Electric Institute Publication No. 70-30 (Apr. 70), 53 p, 12 fig, 5 ref.

Unnumbered report (Aug. 1970), 113 p, 41 fig.

Journal and magazine articles

Nucl. Appl. Tech. 8, 118 (Feb. 1970), 18 p, 6 fig, 16 ref.

Nucl. Engrg. International 14 (155) 325 (Apr. 1970), 5 p, 3 fig.

Conference papers

Preprint of Paper 103, 1970 Am. Power Conf., Chicago, Apr. 20-23, 1970, 14 p, 3 fig, 11 ref.

Abstracts

An abstract may be "indicative" or "informative" or a combination. A purely indicative abstract simply lists or describes the contents of a document, the aim being to do so sufficiently well for a reader of the abstract to decide whether or not to take the time to look at the document itself. An informative abstract, in principle, conveys the major factual results of the document in sufficient detail that most readers would not find it necessary to examine the document itself. Insofar as

is practical, abstracts for the MSRIS are informative. Numbers that require lengthy explanation and qualifications to be meaningful (fuel-cycle costs, for example) are avoided, however. Some documents, such as progress reports and review articles, which cover a wide range of topics, lend themselves only to indicative abstracts. In most other cases, an actual abstract will probably tend to be a combination of indicative and informative.

Whether indicative or informative, the abstract should be written clearly and concisely so as to be quick and easy to read. There is no fixed limit on MSRIS abstracts, but few should exceed about 200 words in length. Having all abstracts as succinct as possible is a great advantage to the user of the file; great enough to warrant special efforts on the part of the writer. In writing an abstract, one should first of all jot down the items of information that he wants to include. Then he should draft the abstract, using direct, concise sentences. Next the writer should edit his draft to eliminate superfluous words and, if necessary, selectively cut the content to get the length down to about 200 words. Finally, he should critically reread his abstract to make sure that each sentence is still complete and clear and that the most important information is still included.

Choice of Keywords

The MSRIS is intended to help anyone seeking information on a chosen subject to find abstracts of all documents containing information pertinent to that subject. Without any knowledge of report titles, authors' names or the like, he should be able to pull the right abstracts from among a multitude of others and be confident that he has not missed any essential information. The keyword index is a mechanism designed to facilitate this.

Each entry in the MSRIS includes a set of keywords chosen from the MSR Keyword List which appears in Appendix A.* In assigning keywords to a

* It may be desirable for the published document itself to carry some keywords not included in the MSRIS list. For example, "molten-salt reactors" is a very important tag for MSR documents in any broader information system, but it would be superfluous in the MSRIS since it would appear on almost every entry.

document, the reviewer or author should ask himself, "If a user wanted this particular abstract, under what set of keywords would he ask the computer to search?" As many keywords may be used as is necessary to fully define the contents of the document. (This varies widely, averaging roughly a dozen.)

The person preparing an MSRIS entry may list keywords in any order, but should place an asterisk immediately before each of the most important keywords. When the computer input is prepared, these will be placed at the head of the list so they can be seen at first glance.

Assignment of Categories and Accession Number

In addition to the information shown in Fig. 3, each entry in the MSRIS file contains an accession number and category identification. The accession number follows routinely from the publication date of the document and its order of processing. The categories are assigned by the MSRIS staff on the basis of suggestions made by the abstractor of the document. Suggestions should be provided both for the primary and any other categories that may be appropriate.

REFERENCES

1. M. W. Rosenthal, P. R. Kasten, and R. B. Briggs, "Molten-Salt Reactors - History, Status, and Potential," Nucl. Appl. Tech., 8, 107 (1970).
2. D. W. Cardwell and P. N. Haubenreich, Indexed Abstracts of Selected References on Molten-Salt Reactor Technology, ORNL-TM-3595 (December 1971).
3. V. A. Singletary, An On-Line Conversational Retrieval System for ORCHIS Text-Oriented Data Bases, User's Manual, ORNL-4951 (April 1974).

APPENDIXES



Appendix A

MSRIS KEYWORD LIST

This list contains 544 keywords that abstractors for MSRIS can use. Interspersed in the list are notes directing anyone with other words in mind to equivalent or related keywords that can be used. An ammended list will be issued if significant additions or changes are made.

A	
absorbers	argon
absorption	(for ASME codes use construction codes)
accidents	
acids	B
actinides	barium
administration	batch processing
adsorption	bearings
AEC	behavior
afterheat	(for bending strength use flexural properties)
aging	beryllium
air	beryllium fluoride
(for Aircraft Reactor Experiment use ARE)	beryllium oxide
alloy composition	beta decay
alloys	bibliographies
aluminum	(for biological effects use health physics)
(for amplifiers use electronics)	(for biological shielding use shielding)
analog systems	bismuth
analysis	blanket
analytical chemistry	blowers
antimony	(for boilers use steam generators)
applications	boiling
architect-engineering	borates
ARE	borides

boron
 boron trifluoride
 (for braze alloys
 use brazing)
 brazing
 (for breeder reactors
 use LMFBR or MSBR)
 (for breeding gain
 use breeding performance)
 breeding performance
 (for breeding ratio
 use breeding performance)
 bromides
 bromine
 Brookhaven National Laboratory
 bubbles
 budgets
 (for buildings
 use structures)
 (for burnable poison
 use reactivity)
 burnout
 burnup

 C

cadmium
 calcium
 calculations
 capacity
 capital costs
 capital equipment
 capsules
 capture
 carbides
 carbon
 (for carbon tetrafluoride
 use fluorocarbons)

carbonates
 carriers
 casting
 catalysts
 (for cavitation
 use fluid flow)
 cells
 (for centrifugal pumps
 use pumps)
 ceramics
 (for cerium
 use rare earths)
 cermets
 certification
 cesium
 (for CF₄
 use fluorocarbons)
 charcoal
 (for charcoal beds
 use absorbers)
 chemical properties
 chemical reactions
 chemistry
 chlorides
 chlorine
 chromium
 (for chromium fluoride
 use corrosion products)
 circulation
 (for circuits
 use electrical circuits)
 cleaning
 closures
 coatings
 cobalt
 (for codes
 use construction codes or
 computer codes)

coke
 (for columbium
 use niobium)
 columns
 compatibility
 components
 compressive properties
 compressors
 computer codes
 computers
 concentration
 conceptual design
 condensers
 (for conductivity
 use electrical conductivity
 or thermal conductivity)
 conferences
 (for confinement
 use containment)
 (for conservation
 use natural resources)
 (for conservation coefficient
 use breeding performance)
 construction
 construction codes
 contactors
 containers
 containment
 contamination
 contracts
 control
 control-rod drives
 control rods
 (for convection
 use thermal convection)
 converters
 coolant loops
 coolants
 cooling
 cooling towers
 copper
 cores
 corrosion
 corrosion products
 corrosion protection
 costs
 cover gas
 cracks
 cranes
 creep
 (for crevice corrosion
 use corrosion)
 (for critical assemblies
 use neutron physics)
 criticality
 cross sections
 crystallization
 cutting tools

D

data
 data acquisition systems
 data processing
 deaerators
 decay
 (for decay heat
 use afterheat)
 decommissioning
 decomposition
 decontamination
 defects
 (for degassing
 use gas separation)

delayed neutrons
 density
 deposition
 description
 design
 design criteria
 design data
 development
 diagrams
 diffusion
 (for digital computer
 use computers)
 disconnects
 dismantling
 dispersions
 disposal
 dissolving
 distillation
 distribution
 disturbances
 (for doppler effect
 use reactivity)
 (for doubling time
 use breeding performance)
 drain tanks
 drying
 ductility
 (for duplex tubing
 use tubing)
 (for dye-penetrant inspection
 use inspection)
 dynamic characteristics
 dynamics tests

E

earthquakes
 economics

efficiency
 elasticity
 electrical circuits
 electrical conductivity
 electrical system
 electrical insulation
 electrical power
 electrical properties
 electrolysis
 (for electrolytes
 use electrolysis)
 (for electrolytic cells
 use electrolysis)
 (for electromagnetic pumps
 use pumps)
 electronics
 electrons
 embrittlement
 emergency cooling
 emission
 energy
 engineered safeguards
 engineering
 enriched materials
 enrichment
 (for enthalpy
 use thermodynamics)
 entrainment
 (for entropy
 use thermodynamics)
 environment
 epithermal neutrons
 (for equations
 use models)
 equilibrium
 equipment
 erosion
 errors

(for eta
use neutron yield)

Euratom

evaporation

examinations

excursions

expansion

experience

experiment

(for explosion
use safety)

extraction columns

extrusion

F

fabrication

failures

fast neutrons

fatigue

feedback

(for feedwater heaters
use steam systems or components)

ferroalloys

fertile materials

films

filters

filtration

(for fire hazard
use safety)

fissile materials

fission

(for fission chambers
use instrumentation)

fission neutrons

fission products

fittings

flanges

(for flaws
use defects)

flexural properties

flooding

flow measurement

(for flowmeters
use flow measurement)

flowsheets

fluid flow

fluids

fluorides

fluorination

fluorine

fluoroborates

fluorocarbons

(for fluxes
use neutron flux or brazing)

foaming

foreign

forming

freeze flanges

freeze valves

freezing

(for freezing point
use solidus)

(for frequency response
use dynamic characteristics)

(for friction factors
use fluid flow)

(for frozen walls
use corrosion protection)

fuel cycle

fuel cycle costs

fuel preparation

(for fuel processing
use processing)

fuels (for graphite moderator
use graphite)
furnaces (for greases
use lubrication)
(for furnace brazing
use brazing)
(for fused salts
use molten salts)

G

gages
(for gain
use breeding performance)
(for gamma heating
use radiation heating)
gamma radiation
(for gamma radiography
use inspection)
gamma sources
gamma spectrometry
gas analysis
gas flow
gas injection
gas separation
gases
(for gaskets
use closures)
generators
germanium
glass
gold
(for grain boundaries
use microstructure)
(for grain density
use microstructure)
(for grain orientation
use microstructure)
(for grain size
use microstructure)
graphite

H

hafnium
halogens
handling
hardness
Hastelloy N
(for hazards
use safety)
(for health hazards
use safety)
health physics
heat
heat balance
(for heat capacity
use specific heat)
heat exchangers
heat generation
heat transfer
heat treatments
heaters
helium
(for Henry's law
use solubility)
(for high-temperature gas-
cooled reactor
use HTGR)
holdup
hot cells
HTGR
hydrates
hydraulics
hydrocarbons

hydrodynamics	(for intergranular corrosion use corrosion)	
hydrofluorination		
hydrogen	(for International Atomic Energy Agency use IAEA)	
hydrogen compounds		
(for hydrostatic tests use testing)		
hydroxides		
<hr/> I <hr/>		
IAEA		
impact strength		
impregnation		
impurities		
incidents		
(for in-core instruments use instrumentation)		
inclusions		
inconels		
industrial development		
industrial studies		
industry		
inert gases		
(for inhibitor use corrosion protection)		
(for INOR-8 use Hastelloy N)		
in-pile tests		
inspection		
instrumentation		
(for instruments use instrumentation)		
(for insulation use electrical insulation or thermal insulation)		
interactions		
interfacial tension		
	(for intergranular corrosion use corrosion)	
	(for International Atomic Energy Agency use IAEA)	
	intrusion	
	inventories	
	iodides	
	iodine	
	ion exchange	
	ionization	
	ions	
	iron	
	iron alloys	
	iron compounds	
	(for iron fluoride use corrosion products)	
	irradiation	
	isotopes	
	<hr/> J <hr/>	
	jigs	
	joints	
	<hr/> K <hr/>	
	kinetic equations	
	krypton	
	<hr/> L <hr/>	
	laboratory equipment	
	(for laminar flow use fluid flow)	
	lattice	
	layout	
	lead	
	lead cooling	

lead detectors
 leak testing
 leakage
 leaks
 (for light-water breeder reactor
 use LWBR)
 limits
 linings
 liquid level measurement
 (for liquid metal-cooled fast
 breeder reactor
 use LMFBR)
 (for liquid metal-fuel reactor
 use LMFBR)
 liquid metals
 liquids
 liquidus
 lithium
 lithium chloride
 lithium fluoride
 LMFBR
 LMR
 loading
 load factor
 loop
 losses
 (for lubricants
 use lubrication)
 lubrication
 LWBR

M

machining
 magnetic properties
 maintenance
 manganese
 manipulators
 mass transfer

materials
 materials testing
 mathematics
 measurement
 mechanical properties
 mechanics
 melting
 (for melting point
 use liquidus)
 membranes
 mercury
 metal transfer process
 metallography
 metallurgy
 metals
 methods
 microprobe
 microstructure
 mists
 mixer-settlers
 mixing
 mixtures
 models
 moderators
 modified Hastelloy N
 modular design
 (for modulus of elasticity
 use elasticity)
 molecular weights
 molten salts
 (for Molten-Salt Breeder
 Experiment
 use MSBE)
 (for Molten-Salt Breeder
 Reactor
 use MSBR)
 (for Molten-Salt Reactor
 Experiment
 use MSRE)

(for Molten-Salt Reactor Program use MSRP)	noble metals
molybdenum	noise analysis
(for molybdenum fluoride use corrosion products)	nuclear analysis
monitors	nuclear reactions
MSBE	O
MSBR	off-gas systems
MSBR Associates	(for on-line computers use computers)
molten-salt group	operating costs
MSRE	operation
MSRP	operators
N	optics
(for NaF use sodium fluoride)	optimizations
(for NaBF ₄ or NaBF ₄ -NaF use fluoroborates)	(for ore use natural resources)
NaK	organics
(for natural convection use thermal convection)	oxidation
natural resources	oxide precipitation process
neptunium	oxides
neutron fluence	oxygen
neutron flux	P
(for neutron heating use radiation heating)	parametric studies
neutron physics	(for passivation use corrosion protection)
neutron sources	performance
neutron spectra	(for periscopes use viewing devices)
neutron yield	phase equilibria
nickel	physical properties
nickel alloys	pilot plants
(for nickel fluoride use corrosion products)	pipng
niobium	plans
nitrates	plant
nitrogen	plutonium
	plutonium fluorides

(for poisoning (neutron)
 use reactivity)
 potassium
 potassium fluorides
 (for power
 use electrical power or thermal
 power)
 power costs
 power measurement
 precipitation
 pressure
 pressure vessels
 primary salt
 primary system
 procedures
 processing
 procurement
 production
 progress report
 protactinium
 protactinium fluorides
 prototypes
 pumps
 (for purchasing
 use procurement)
 pyrocarbon

Q

qualifications
 quality assurance
 quenching

R

radiation damage
 radiation heating
 radiation measurement
 (for radioactive wastes
 use wastes)
 radioactivity
 (for radiography
 use inspection)
 radiolysis
 (for Rankine cycle
 use steam cycle)
 rare earths
 rare gases
 (for rates
 use reaction rates)
 reaction rates
 reactivity
 (for reactor core
 use core)
 reactors
 reactor vessel
 recombination
 reduction
 reductive extraction process
 refractory metals
 (for regulating rod
 use control rods)
 reliability
 remote maintenance
 remote welding
 replacement
 research
 (for resources
 use natural resources)
 reviews
 (for Reynolds number
 use fluid flow)
 (for rod drives
 use control-rod drives)

rupture	(for sources use gamma sources or heat sources or neutron sources)
(for rupture life use creep)	
(for ruthenium use noble metals)	
S	
safety	
safety limits	
(for safety rods use control rods)	
(for samarium use rare earths)	
samplers	
sampling	
schedules	
sealing	
seals	
secondary salts	
secondary systems	
separations	
shielding	
(for shim rods use control rods)	
shrinkage	
simulation	
single-fluid reactors	
sites	
siting	
sodium	
sodium fluoride	
(for sodium fluoroborate use fluoroborates)	
solidus	
solubility	
solvents	
	sparging
	specific heat
	specific inventory
	specifications
	spectrophotometry
	spheres
	sprays
	stability
	stacks
	stainless steels
	standards
	startup
	statistics
	steam cycle
	steam generators
	steam systems
	storage
	stress
	(for stress corrosion use corrosion)
	(for stress cycling use fatigue)
	stress rupture
	strontium
	structures
	sulfur
	(for supercritical water use steam cycle)
	surface tension
	surveillance
	systems

 T

tantalum
 (for techniques
 use methods)
 (for television
 use viewing devices)
 (for tellurium
 use noble metals)
 (for temperature coefficient of
 reactivity
 use reactivity)
 temperature measurement
 (for Tennessee Valley Authority
 use TVA)
 tensile properties
 test facilities
 testing
 theory
 thermal conductivity
 thermal convection
 thermal effects
 thermal insulation
 thermal neutrons
 thermal power
 thermal properties
 thermal shield
 thermal shock
 (for thermocouples
 use temperature measurements)
 thermodynamics
 (for thermometry
 use temperature measurement)
 thorium
 thorium fluorides
 titanium
 (for titanium additions
 use alloy composition)

tools
 (for toughness
 use impact strength)
 tracers
 training
 tritium
 tubing
 tungsten
 turbines
 (for turbogenerators
 use turbines)
 (for turbulent flow
 use fluid flow)
 TVA
 two-fluid reactor

 U

 (for ultimate strength
 use tensile properties)
 (for ultrasonic inspection
 use inspection)
 uranium
 uranium fluorides
 uranium-232
 uranium-233
 uranium-235
 (for U. S. Atomic Energy
 commission
 use AEC)
 utilities

 V

 (for vacuum distillation
 use distillation)
 valves
 vapor pressure
 vibration

viewing devices
viscosity
void fractions
volatility
volume fractions

W

wastage
waste disposal
wastes
water
weigh cell
welding
wetting

X

xenon
x-rays

Y

(for yield strength
use tensile properties)

Z

zirconium
zirconium fluoride

Appendix B

SUBJECT CATEGORIES IN MSRIS

This list presents the current set of subject categories to be used for documents abstracted in MSRIS.

<hr/>	
A	Molten-Salt Reactor Programs
AA	MSRP - Plans and Organizations
AB	MSRP - Technical Summaries
AC	MSRP - Progress Reports
ACA	MSRE
ACB	Large MSRs
ACC	Salt Processing
ACD	Chemistry
ACE	Materials
AD	MSR Activities Outside MSRP
<hr/>	
B	Reactor Analysis
BA	Nuclear Data
BB	Static Neutronics
BC	Dynamics
BD	Thermal Effects
BE	Activation, Radiation and Shielding
BF	Fuel Cycle and Economics
BG	Safety
BH	Computer Programs
<hr/>	
C	Reactor Chemistry
CA	Phase Relations
CB	Thermodynamics and Equilibria
CC	Rates and Diffusion
CE	Corrosion Reactions
CF	Fission Product Behavior
CG	Tritium Behavior
CH	Oxide Behavior
CI	Crystal Studies
CJ	Surface Effects
CK	Electrochemistry
CL	Radiolysis
<hr/>	
D	Analytical Chemistry
<hr/>	
E	Graphite
EA	Fabrication
EB	Unirradiated Properties
EC	Irradiation Effects
ED	Applications
<hr/>	
F	Hastelloy N and Related Alloys
FA	Alloys Leading to Hastelloy N
FB	Standard Hastelloy N
FBA	Microstructure
FBB	Fabrication
FBC	Mechanical and Physical Properties
FBD	Corrosion
FBE	Radiation Damage
FC	Modified Hastelloy N
FCA	Microstructure
FCB	Fabrication
FCC	Mechanical and Physical Properties

FCD	Corrosion	IB	Systems
FCE	Radiation Damage	IBA	Fuel
<hr/>		IBB	Coolant
G	Materials Other Than Hastelloy N and Graphite	IBC	Steam
GA	Stainless Steels	IBD	Gas
GB	Steels other than Stainless	IBE	Containment
GC	Nickel and Ni-Base Alloys other than Hastelloy N	<hr/>	
GD	Molybdenum and Mo-Base Alloys	J	Instrumentation and Controls
GE	Brazing Alloys	JA	General
GF	Other Metals	JAA	Instrument Development
GG	Nuclear Control Materials	JAB	Plant Control
<hr/>		JB	Nuclear Control and Plant Safety
H	Reactor Component Development	JC	Process
HA	Core	JD	Radiation and Contamination Monitoring
HB	Pumps	JE	Data Collection and Analysis
HC	Heat Exchangers	JF	Communication and Surveil- lance
HD	Steam Generators	JG	Electrical and Pneumatic Systems
HE	Gas Injection and Removal	<hr/>	
HF	Valves	K	Operation and Maintenance
HFA	Freeze Valves	KA	Operation
HFB	Mechanical Valves	KAA	ARE
HG	Flanges	KAB	MSRE
HH	Heaters	KAC	Other Molten-Salt Systems
HI	Other Components	KB	Maintenance
<hr/>		KBA	MSRE Maintenance
I	Reactor Design	KBB	Other Molten-Salt and Radioactive Systems
IA	Reactor Plant	<hr/>	
IAA	Early Molten-Salt Reactors		
IAB	MSRE		
IAC	One-Fluid MSBR (Reference Design)		
IAD	Other Thermal Molten-Salt Reactors		
IAE	MSBE		
IAF	Fast and Epithermal Molten-Salt Reactors		

L Fuel Preparation and Processing
LA Salt Procurement and Preparation
LB Fluorination
LC Distillation
LCA Experimental Basis
LCB Engineering Development
LCC Operating Experience
LD Reductive Extraction
LDA Experimental Basis
LDB Engineering Development
LE Metal Transfer
LEA Experimental Basis
LEB Engineering Development
LF Oxide Precipitation
LFA Experimental Basis
LFB Engineering Development
LG Adsorption and Reduction
LH Salt Purification
LI MSRE Salt Processing
LJ Plants for Two-Fluid MSBR
LK Plants for One-Fluid MSBR

M MSRE
MA Design
MAA Plant
MAB Major Component
MAC Instrumentation and Controls
MAD Auxiliary Systems and Components
MB Construction
MC Operation
MCA Program
MCB Procedures
MCC Training
MCD Experience
MD Analysis
MDA Theoretical
MDB System Performance
MDC Nuclear Performance
ME Maintenance
MEA Principles
MEB Procedures
MEC Experience
MF Decommissioning

N Miscellaneous

Appendix C

INSTRUCTIONS FOR USE OF MSRIS FROM AN
INTERACTIVE COMPUTER TERMINAL

Searches of the MSRIS file may be conducted by simultaneous users from teleprinter terminals connected to the ORNL central computer through the public dial telephone system. These searches are carried out by the computer program, ORLOOK, which has access to a number of other analogous files. ORLOOK, in turn, is only one of many computer procedures that can be used from remote terminals through the computer Time Sharing Option (TSO). Thus, the prospective user of MSRIS must:

1. Establish a telephone connection to the computer.
2. Gain access to TSO by appropriate user identification.
3. Invoke the ORLOOK procedure.
4. Select the MSRIS file.

Upon completion of the search, the user must:

1. Terminate the ORLOOK session.
2. Sign off from TSO.
3. Release the telephone connection.

In preparation for an initial session, the user will need first to gain some understanding of distinctive characteristics of the terminal available to him as they relate to operations desired.

Obtaining Terminal Connection to Computer

For purposes of these instructions, terminals may be considered to fall into two general classes:

Class I: IBM compatible-15 Char./Sec., Upper and Lower Case
(IBM Model 2741, NOVAR Model 5-50, etc.)

Class II: Teletype compatible

- a. 10 Char./Sec., Upper Case Only
(Teletype Models 33 or 35, etc.)
- b. 30 Char./Sec., Upper and Lower Case
(Teletype Model 37, G.E. Terminet Model 300, I/O Devices Model 100, Tex. Instr. Model 700, Beehive CRT Model IA, etc.)

For Class I Terminals (IBM compatible), the following steps are required to obtain a telephone connection to the computer:

1. In preparation for typing messages to the computer, the user must recognize the difference between the numeric character "1" (key number zero on a standard typewriter keyboard) and the alphabetic character "l" (key number 34) which is often used as a l in typing. Care must also be taken not to confuse the zero numeric key (number 35) with the alphabetic "o" key (number 33). Of the various print balls available, IBM selectric typewriter, No. 527 (Waterloo correspondence) should be used on most terminals to obtain a character set appropriate for the computer system employed for MSRIS.
2. See that the telephone coupler is turned on and its selector switch is positioned to "HALF DUPLEX" (labeled "H.D.," or "COPY" on some models).
3. Dial 3-1021 or 3-1041.* Following ring, listen for a steady high-pitched tone, then place the telephone handset firmly in the cradle or coupler, positioning cord-to-cord. (It is assumed here that an acoustic coupler is used; otherwise the user should check with the terminal custodian for variations in procedures.)
4. Turn on the terminal. If the coupler or teleprinter is equipped with a "CARRIER" or "XMIT" indicator light, it will illuminate to show that connection has been made to the computer. The user may now proceed to give his identification to initiate searches for documents in the MSRIS as will be explained.

For Class II Terminals (Teletype compatible), the steps to obtain telephone connection to the computer are similar to those given for Class I, with a few exceptions, as follows:

1. Characters printed by most terminals in this class are fixed to the standard set for Model 33 teletypes. Some function keys, such as those labeled "CONTROL" and "ESC" are not used with MSRIS, so they will not be explained here.

* All telephone numbers given here are in-plant extensions. For authorized user connection by FTS lines, dial (615) 483 followed by the last four digits of the extension.

2. Same as 2 above.
3. Dial 3-1011 for 10 Char./Sec. teletype-compatible terminals.
Dial 3-1051 for 30 Char./Sec. teletype-compatible terminals.
Upon hearing the steady high-pitched tone place the handset in the coupler as in 3 above.
4. Turn on the terminal by positioning the LOCAL/OFF/LINE switch to "LINE."

Logging On and Off for MSRIS
(See Example 1)

After obtaining a telephone connection to the computer, as described above, the user should proceed, without unreasonable delay to "log on" and then invoke the ORLOOK procedure from which the MSRIS file can be selected. In applying the instructions, given below, care must be exercised to type the statements exactly as shown, including spaces. The one exception to this rule is in the use of upper case and lower case alphabetic characters. In this Appendix, we have chosen to show messages typed by the user and responses from the computer in upper case characters to distinguish them from the remainder of the text. However, if the user's terminal has both upper and lower case alphabetic characters, user input may be typed in all upper case, all lower case, or any combination thereof, with due consideration for non-alphabetic characters that may not have equivalent upper and lower case forms. In addition, computer output through such terminals will appear with the usual mix of upper and lower case alphabetic characters.

1. Type LOGON, and press RETURN. (In all cases, after typing the required characters, the user must press the RETURN key to transmit the data to the computer. In all subsequent instructions, proper use of the RETURN key will be assumed.)

NOTE: With IBM-compatible terminals, if a wrong key is struck, use BACKSPACE and strike over to correct the error; with teletype compatibles, use BACKARROW, which is obtained by holding down the SHIFT while striking the alphabetic O key.

2. The computer responds to LOGON with a set of characters identifying the job and the request ENTER USERID-. The user may then transmit the 3-character user identification (e.g. XXX) as assigned by computer center personnel.
3. When the USERID is accepted, the computer prompts the user to ENTER PASSWORD FOR XXX-. The user may then enter a 3-character password, also assigned by computer center personnel.
4. If the password is also acceptable, the computer responds with: XXX LOGON IN PROGRESS AT (time) ON (date), followed by any current bulletins to TSO users and a listing of any special procedures specifically cataloged under XXX. A final message, READY, indicates that the user now has gained access to TSO and the computer is ready for action.
5. The ORLOOK procedure is then invoked by simply transmitting the word ORLOOK. The computer response is then the date, time, any user messages, and the question:

DATABASE PUBLIC/PRIVATE/OTHER/STOP?

The proper user response to lead to use of MSRIS is to transmit the word PUBLIC.

6. The computer responds by typing a list of the number of each data FILE and the title of the associated DATABASE. (Example 1 presents only part of the total listing. This listing, and any other message being transmitted by the computer, may be interrupted by pressing the ATTN key on IBM-compatible terminals or the BREAK key on teletype terminals. The computer will then proceed to the next step in the procedure that is in effect. The exclamation point in DATABASE #6 indicates that the message was interrupted.) Upon completion, or interruption, of the ORLOOK list, the computer requests:

SELECT FILE #:

and the user, noting (or knowing) that the Molten Salt Reactor Information File is item #4, types simply

7. The computer then responds:

```
4 MOLTEN SALT REACTOR INFORMATION FILE
ORLOOK READY
```

The user may now conduct selective searches for molten salt reactor publications through various avenues of approach as will be described. The period (.) on the last line of the computer response is the ORLOOK system's indication that it is the user's turn to transmit a command.

Upon completion of a session the user must release the ORLOOK procedure and "sign off" from TSO. The procedure, also illustrated in Example 1, is as follows:

1. At any time that ORLOOK is ready to accept a command (as indicated by the period), simply transmit the command:

```
STOP
```

The computer responds with the message:

```
END ORLOOK SESSION
```

plus an indication of the computer time used and the present time.

2. Since the user is still in the TSO mode of operation, the computer then transmits the TSO message:

```
READY
```

to indicate that another procedure may be invoked. The user then transmits the command:

```
LOGOFF
```

to which the computer responds with

```
XXX LOGGED OFF TSO AT (time) ON (date) +
```

3. Finally the user must hang up the telephone handset or otherwise sever the telephone connection. It is important that this be done in order not to hold open one of the computer communication lines.

Elementary Search of the MSRIS File
(See Example 2)

Having selected the MSRIS file, searches may be conducted for documents containing specified subject matter by typing LOOK* commands which take the general form of:

LOOK '.....'

where words describing the subject matter are placed between the single quotes. Always follow primary commands, such as LOOK, by a space. (The elementary command, as here written, can be given a number of optional modifications for more refined searches which will be explained later.) To each such command the computer responds with a period. The user may then supply additional commands or request execution of the commands that have been given. To initiate action on a LOOK command or a series of such commands, the user must type END, and the search will be initiated.** In the initial search, the computer responds:

SEARCHING SUBSET NO. 0

After a pause, that varies in length depending on the size of the file and how busy the computer is at the moment, the following response will be received:

....DOCUMENTS IN FILE
ANSWERS IN SUBSET NO. 1
....DOCUMENTS IN RESULT

where the first blank is the size of the whole MSRIS file, and the second blank gives the number of file entries found to contain the subject matter specified. (The search is conducted without any distinction between upper case and lower case characters in subject matter.) Usually, the second number is large, so subsequent LOOK commands are entered to refine the search further, before asking the computer to LIST the findings. Answers

* A glossary of frequently used ORLOOK commands is presented later in this appendix.

** Action on most other commands is automatically initiated when the command is entered.

will be collected in SUBSETS 1, 2, 3, etc. It is important to emphasize here that each successive search is automatically applied to the most recently isolated subset file unless the user enters the command SUBSET followed by a number. For a new search against all of MSRIS, enter SUBSET 0. At any time that the computer provides a period, the command LIST can be given to cause the last acknowledged subset to be typed out on the terminal. (The local printout can be interrupted before completion by pressing the ATTN key on IBM compatible terminals, or the BREAK key on teletype compatible terminals.) For large listings, it will be preferable to give the command PRINT rather than LIST, to produce printouts on a high-speed line printer at the computer center for subsequent delivery by courier. As will be shown later, the LIST and PRINT commands can be given optional modifiers to select portions of subsets to be produced in any order that may be desired.

Selective Search for Documents by Field
Labels and Selective Print
 (See Example 3)

From the last example, it will be noted that each MSRIS file entry has labels that define fields for each reference. Searches may be conducted, (and listings can be made) according to fields or combinations of fields. The labels actually used and their abbreviations are as follows:

<u>Label</u>	<u>Abbreviation</u>
HEADER	H
AUTHOR	AU
TITLE	TI
PUB DESC	PU
SUBJ CAT	SU
KEYWORDS	KE
ABSTRACT	A

In entering a search command, labels must be enclosed within pre-scribed delimiter characters. For the IBM-compatible terminals (with Waterloo correspondence print ball) the command will have the form:

.LOOK <AU> = 'TALLACKSON'

where the delimiter symbol "<" comes from pressing the SHIFT and striking

the first key on the top row and the ">" symbol comes from SHIFT and striking the last key on the second row. (If the Waterloo correspondence print ball is not used, the characters will usually print as "l" and "l/4" respectively.) With teletype-compatible terminals, the delimiter "<" is obtained by holding down the SHIFT key and striking the comma key and ">" is obtained with SHIFT and the period key. Where searches are delimited by labels, only the designated fields will be searched, whereas without labels every word of the text is searched, which takes more time to accomplish.

The LIST or PRINT command may be given modifiers to either limit which fields of a reference are provided, or to change the sequence of the fields. Such a command takes the form:

```
.LIST AU,TI,A
```

where a space must follow the primary command and modifiers are separated by commas. A command in this form will be applied to the preceding subset that has been isolated, unless a reference number is given in the form:

```
.LIST 8,AU,TI,A
```

This will give the AUTHOR, TITLE, and ABSTRACT for reference number 8 (the eighth sequential reference of the entire MSRIS file and printed as ### 8 #####).

Searching by delimited fields and listing or printing by delimited fields are independent of each other, so they can be mixed as may be desired.

Searching by Logical Combinations (See Example 4)

To achieve more efficient searches for MSRIS documents, the elementary LOOK command may be given sharper focus by expanding to one or more of the following forms:

(a) .LOOK 'X' and 'Y'

.END

This combination will find references containing both 'X' and 'Y'. (If "and" is omitted in this command, viz., LOOK 'X' 'Y', it will get the same result.) From one to four search items may be specified. Note that for the combination used in Example 4, only one document was found in the data file.

```
(b) .LOOK 'X'
      .LOOK 'Y'
      .END
```

This combination will find all references in which either 'X' or 'Y' occurs. Up to ten LOOK commands may be entered, and they may contain single or multiple search items. In the example, 35 documents were found when the same two keywords were specified in the OR format.

```
(c) .LOOK 'X'
      .LOOK NOT 'Y'
      .END
```

This format will collect references containing the search item 'X' but not containing 'Y'. As many as ten LOOK commands may be specified with NOT preceding the search items in addition to the ten allowed without NOT specified.

In these combination commands, individual search items may be given label delimiters confining the fields to be scanned, as in this example, or they may be left unlabeled. For instance,

```
.LOOK 'HEAT TRANSFER'
      .LOOK NOT <AU> = 'MCCOY'
      .END
```

will find references that contain, in any field, the words 'heat transfer' and are authored by others than McCoy.

Correcting Errors in Search Commands

As the user learns to formulate increasingly complex commands to achieve efficient searches, the likelihood of making errors will become greater. Most such errors can readily be corrected, employing conventions available within ORLOOK. At any point during a session between LOGON and LOGOFF, miskeying can be remedied by the BACKSPACE (or BACKARROW on teletypes). While in the course of typing a LOOK command before RETURN has been pressed, that line can be entirely deleted by striking the @ key. If it is desired to eliminate an immediately preceding LOOK command, type CANCEL and press RETURN. If it is desired to eliminate an entire series of LOOK COMMANDS, type CANCEL ALL, and re-enter the desired commands. The ATTN key (BREAK on teletype) may be employed to interrupt any computer operation and return control to the user.

Efficient Search Strategies

Before initiating a terminal search for MSRIS documents, a user should select a strategy most likely to achieve his objective accurately and rapidly. Taking full advantage of interactive capabilities, the usual approach will involve entering an initial LOOK command describing the general area of interest to obtain SUBSET #1 against which file of reduced size subsequent searches may be directed. Without returning to the complete MSRIS library (SUBSET #0), he may proceed to: (1) browse through that collection of references to obtain an overall idea of information available on selected topics; (2) locate a set of documents to generate a bibliography; or (3) make a definitive search for a specific publication or publications.

Browsing (See Example 5)

To illustrate strategy for browsing, let us assume the user wishes to discover what documents are available on properties of Hastelloy N and modified Hastelloy N. Entering the command LOOK 'Hastelloy N', although permissible, would cause the computer to painstakingly examine every line of the MSRIS file looking for this string of characters and would, of

course, collect in a subset a large number of references, many of them irrelevant. So, a preferable beginning would be made (observing from the MSRIS subject categories list that category FB denotes "Hastelloy N" and FC denotes "Modified Hastelloy N") by typing:

```
.LOOK <H> = 'FB'
.LOOK <H> = 'FC'
.END
```

As SUBSET #1, the computer would combine the references from the FB and FC categories and indicate the total number found. This group of references could then be explored with further LOOK commands to determine what documents include information on specified properties.

When the topic to be browsed does not fall into an MSRIS subject category, an initial search command employing some other delimiter or combination of delimiters may be employed to obtain a representative SUBSET #1. For instance, to explore outside literature collected on "heat transfer," a search might begin with:

```
.LOOK <KE> = 'HEAT TRANSFER'
.LOOK NOT <PUB> = 'OAK RIDGE'
.END
```

Bibliographies (See Example 6)

Where it is desired to obtain a collection of documents covering an extensive topic for time-consuming study, a broad search should be initiated, followed by entry of a PRINT command to produce complete copy on the computer center high-speed line printer for courier delivery. For instance, a user wishing to make a bibliographic study of "corrosion products" may enter on the terminal:

```
.LOOK <KE> = 'CORROSION'
.END
```

If the number of documents reported appears too large to handle, other search commands may be entered.

From subsets of related references it will sometimes be desirable to obtain combinations using the COMBINE command as follows:

.COMBINE 1 AND 2

will assemble a new subset of references common to both SUBSET #1 and SUBSET #2

.COMBINE 1 OR 2

will assemble a new subset containing all references that appear in either SUBSET #1 or SUBSET #2

.COMBINE 1 NOT 2

will assemble a new subset containing SUBSET #1 references but excluding those that also appear in SUBSET #2.

Occasionally a user may wish to have a hard copy of results, but does not want to wait for it to be typed at the terminal. Such copy may be obtained by entering the command:

.PRINT

When the computer returns the word PRINTED and a period, terminal-control has been restored to the user. The LIST (or PRINT) command with modifiers can be used to obtain a structured bibliographic summary. Another type of bibliographic search often useful is a search by authors, either modified or unmodified by some topical parameter.

Definitive searches

Definitive searches to pinpoint some discrete piece of information may take many forms. As users become experienced with the system operation and familiar with the file structure, they may be able to formulate single search combinations that will hit their objectives, but that is somewhat risky with respect to the possibility of missing relevant documents. Thus, it will usually prove desirable to first define the general area of interest so as to set up an initial SUBSET of reasonable size on which successive LOOK commands may operate. If first attempts do not hit desired targets, returns can be made to that SUBSET for further operations

using different combinations of field delimiters. The various subsets generated in Example 6 could, for example, be used in additional searches.

Auxiliary Operations

Summary tabulations (See Example 7)

It is useful either at the end of an ORLOOK session, or sometime during the course of a rather extensive one, to have the computer formulate on the terminal a tabulation of the successive search transactions. Such an output can be obtained whenever desired by entering the command:

.REQUEST

The first column of the tabulation provides a ready reference of the SUBSET # developed for the search items shown in the last column, as a guide to further probing among designated collections of references. Efficiencies of successive sessions can be improved by study of request summaries.

Search-field LABEL identification (See Example 8)

During the course of an ORLOOK session, if a user needs a reminder of field identifier LABELS and their abbreviations, he may enter the command LABELS. All LABELS recognized by the general ORLOOK program will be listed; however, only a few of these are applicable to MSRIS as shown in Example 8.

The LOOK command when used without a field delimiter (as in Example 2) causes the computer to search all fields of each entry for the object of the command. (This is the "default" option built into the program.) This rather time-consuming process can be avoided by designating a field as in Example 3. However, field designation can also become time consuming (and monotonous) if a user wishes to execute a large number of LOOK commands within a given field type. To avoid this latter problem, the user may change the default option to cause searching of any one field when an unmodified LOOK is entered. To accomplish this the user enters the command:

.RESET

to which the computer response is:

KEY FIELD LABEL?

After the user enters the abbreviation of the LABEL selected, e.g., KE, and the computer acknowledges

KEYWORDS SELECTED

that LABEL will be applied in all subsequent LOOK commands that are not otherwise delimited. In this example, the command:

LOOK '.....'

will search only the KEYWORDS fields for the desired expression. A return to the original mode, where all fields are searched when LABELS are undesignated, may be accomplished by entering RESET again and responding to the computer's question with ALL.

Terminal controls

The standard length of a line in ORLOOK transactions is limited to 80 characters for IBM compatible terminals and 70 characters for teletypes. To alter the length, the following command may be entered:

.LINE TERMINAL, ---

substituting a two-or-three-digit figure for the dashes to designate the number of characters desired. Similarly, prior to using the PRINT command, maximum length of lines produced by the central computer line printer can be altered by entering the command:

.LINE PRINTER, ---

Return to original line length limitations can be obtained by reentering the commands and specifying 80 characters for IBM-compatible terminals and 70 characters for teletypes.

NOTE: Operations such as RESET and LINE TERMINAL appear to, and in fact do, alter the basic ORLOOK program. However, these alterations do not affect others who may be using the program at the same time; nor do they remain in effect after the user concludes his session. Each user who invokes the ORLOOK procedure is provided with a "fresh" copy of the

original (and unalterable) program in a volatile region of the computer memory. That copy, and any changes made in it by the user, remain available only for the duration of that session (unless special storage is prearranged and used). Thus, special features must be entered each time they are used, but they need not be removed.

Glossary of ORLOOK Commands for MSRIS

To begin and end a session

LOGON	Begins session with TSO
ORLOOK	Invokes ORLOOK procedure
STOP	Ends ORLOOK session
LOGOFF	Terminates TSO

To conduct searches

LOOK 'aaaa'	Searches all fields of references for aaaa.
LOOK 'aaaa' 'bbbb'	Searches all fields for aaaa and bbbb occurring in the same reference, not necessarily in the same field.
LOOK not 'bbbb'	Searches all fields for each reference without bbbb.
LOOK 'aaaa'} LOOK 'bbbb'}	Searches all fields for aaaa or bbbb and combines the results.
LOOK < -- > = 'aaaa'	Searches -- field for aaaa.
END	Completes the set of LOOK commands and starts the search.

To define reference sets to be searched

SUBSET 0	Directs the subsequent search against the entire MSRIS file.
SUBSET --	Directs subsequent search against the previously collected SUBSET #--.
COMBINE 1 AND 2	Assembles a new subset of references common to SUBSET #1 and SUBSET #2.
COMBINE 1 OR 2	Assembles a new subset combining all references that appear in either SUBSET #1 or SUBSET #2.

COMBINE 1 NOT 2	Assembles a new subset from SUBSET #1, excluding any that also appear in SUBSET #2.
@	Deletes the line being typed.
CANCEL	Cancel the preceding LOOK command; when modified with ALL, cancels the current series of LOOK commands.
LABELS	Lists key-field labels.
RESET	Indicates user's desire to name a new default label.

To obtain results

LIST	Types out, on the terminal, all fields of the last subset.
LIST ---	Types out, on the terminal, all fields of reference number ---.
LIST ,-,,-	Types out, on the terminal, the fields specified by the blanks, and in that order, from the last subset.
SUBSET -- } LIST --,-- }	Types out, on the terminal, the references collected in subset --, for the fields specified in LIST.
PRINT	Prints, on a computer-center line printer, all fields of the last subset - may be given modifiers as shown for LIST.
LINE TERMINAL ,---	Changes the maximum line length typed on the terminal to --- characters.
LINE PRINTER ,---	Changes the maximum line length produced by the line printer to --- characters.
REQUEST	Types out, on the terminal, a summary tabulation of LOOK commands and results obtained during the current session.

Example 1

Logging On and Off for MSRIS Via
IBM-Compatible Terminal

```
logon
IKJ56700A ENTER USERID -
████
ENTER PASSWORD FOR █████-
%████
%████ LOGON IN PROGRESS AT 13:35:11 ON APRIL 17, 1975
10/21/74 TSO phone nos.- 2741: 31001, 31021, 31041; tty: 31011 (10cps), 31051 (30 cps)
READY
orlook
```

```
DATE = 04-17-75    TIME NOW = 13.36.27
++++ 3-5-75 +++++ WELCOME TO ORLOOK, CALL 3-6097 IF PROBLEMS ARISE
```

```
DATABASE PUBLIC/PRIVATE/OTHER/STOP ? PUBLIC
```

```
FILE #      DATABASE
  1  FORESTRY SOURCE FILE I
  2  IBP ABSTRACT
  3  COAL TECHNOLOGY LIBRARY FILE
  4  MOLTEN SALT REACTOR INFORMATION FILE
  5  URBAN TECHNOLOGY
  6  MODELING BI!
SELECT FILE #: 4
  4  MOLTEN SALT REACTOR INFORMATION FILE
```

```
ORLOOK READY
```

```
.stop
END ORLOOK SESSION
```

```
CPU(SEC) USED = 3.40    LAPSED (HR.MIN.SEC) = 00.04.28
TIME NOW = 13.40.55
```

```
READY
logoff
████ LOGGED OFF TSO AT 13:41:50 ON APRIL 17, 1975+
```

Example 1

Logging On and Off for MSRIS Via
Teletype Terminal

```

LOGON
IKJ56700A ENTER USERID -
█████
ENTER PASSWORD FOR █████-
█████
█████ LOGON IN PROGRESS AT 17:20:11 ON MARCH 11, 1975
10/21/74 TSO PHONE NOS.- S741: 31001, 31021, 31041; TTY: 31011 (10CPS),
31051 (30 CPS)
8/15/74 NEW COMMAND PROCEDURE SQUISH NOW AVAILABLE. TYPE ORNLIS0 SQUISH.
SHOW FAILED - NO CATALOG ENTRIES FOUND FOR '█████'
READY
ORL00K

```

```

DATE = 03-11-75    TIME NOW = 17.21.01
++++ 3-5-75 +++++ WFLC0MF T0 ORL00K, CALL 3-1604 IF PROBLEMS ARISE

```

DATABASE PUBLIC/PRIVATE/OTHER/STOP ? PUBLIC

```

FILE #      DATABASE
  1  FORESTRY SOURCE FILE I
  2  IBP ABSTRACT
  3  COAL TECHNOLOGY LIBRARY FILE
  4  MOLTEN SALT REACTOR INFORMATION FILE
  5  URBAN TECH!
SELECT FILE #: 4
  4  MOLTEN SALT REACTOR INFORMATION FILE

```

ORL00K READY

```

.STOP
END ORL00K SESSION

```

```

CPU(SEC) USED = 3.00    LAPSED (HR.MIN.SEC) = 00.01.31
TIME NOW = 17.22.32

```

```

READY
LOGOFF
█████ LOGGED OFF TSO AT 17:23:07 ON MARCH 11, 1975+
>R

```

Example 2

Elementary Search of the MSRIS File

.look 'safety'

.end
SEARCHING SUBSET # 0

373 DOCUMENTS IN FILE
ANSWERS IN SUBSET # 1
22 DOCUMENTS IN RESULT

.look 'control rod'

.end
SEARCHING SUBSET # 1
ANSWERS IN SUBSET # 2
5 DOCUMENTS IN RESULT

.list

**** SUBSET # 2 ****

8 #####
<HEADER >AAX670010
<AUTHSHIP>
<AUTHOR >Kasten, P.R.
<TITLE >SAFETY PROGRAM FOR MOLTEN-SALT BREEDER REACTORS
<REFERENC>
<PUB DESC>Oak Ridge National Laboratory, Tenn. ORNL-TM-1858 (June 1967) 42 p, 6
fig, 3 ref.
<KEYTERMS>
<SUBJ CAT>AAX ; BGX
<KEYWORDS>*MSRP; *safety; *analysis; *plans; reactivity; MSBR ; accidents;
costs; containment; stability ; dynamic characteristics; off-gas systems;
processing
<ABSTRACT>Investigations required in determining the safety characteristics of
MSBR power plants are outlined, and the safety features of the major plant
systems are described. Reactivity additions w-hic!

Example 3Selective Search for Documents by Field
Labels and Selective Listing

.look <au> = 'Tallackson'

.end

SEARCHING SUBSET # 0
ANSWERS IN SUBSET # 3
4 DOCUMENTS IN RESULT

.list au,tl,pub

**** SUBSET # 3 ****

6

<AUTHOR >Tallackson, J.R.; Moore, R.L.; Ditto, S.J.
<TITLE >INSTRUMENTATION AND CONTROLS DEVELOPMENT FOR MOLTEN-SALT BREEDER
REACTORS
<PUB DESC>Oak Ridge National Laboratory, Tenn. ORNL-TM-1856 (May 1967), 36 p, 2
ref.

247

<AUTHOR >Tallackson, J.R.
<TITLE >THERMAL RADIATION TRANSFER OF AFTER HEAT IN MSBR HEAT EXCHANGERS
<PUB DESC>Oak Ridge National Laboratory, Tenn. ORNL-TM-3145 (March 1971), 108 p,
43 fig, 28 ref.

302

<AUTHOR >Tallackson, J.R.
<TITLE >NUCLEAR AND PROCESS INSTRUMENTATION -- PART IIA, MSRE DESIGN AND
OPERATIONS REPORT
<PUB DESC>Oak Ridge National Laboratory, Tenn. ORNL-TM-729 (Feb. 1968), 397 p,
180 fig, 102 ref.

331

<AUTHOR >Beall, S.E.; Haubenreich, P.N.; Lindauer, R.B.; Tallackson, J.R.
<TITLE >MSRE DESIGN AND OPERATIONS REPORT, PART V -- REACTOR SAFETY ANALYSIS
REPORT
<PUB DESC>Oak Ridge National Laboratory, Tenn. ORNL-TM-732 (Aug. 1964), 300 p,
109 fig. 50 ref.

*** END LIST

.list 6,a

6

<ABSTRACT>Instrumentation used in the MSRE is a good basis for development of
the instrumentation for large molten-salt br!

Example 4

Searching by Logical Combinations

```
.look <ke> = 'heat transfer' and <ke> = 'liquid metals'  
.end  
SEARCHING SUBSET # 0  
  
373 DOCUMENTS IN FILE  
ANSWERS IN SUBSET # 1  
1 DOCUMENTS IN RESULT  
  
.subset 0  
  
.look <ke> = 'heat transfer'  
.look <ke> = 'liquid metals'  
.end  
SEARCHING SUBSET # 0  
ANSWERS IN SUBSET # 2  
35 DOCUMENTS IN RESULT  
  
.subset 0  
  
.look <ke> = 'heat transfer'  
.look not <ke> = 'liquid metals'  
.end  
SEARCHING SUBSET # 0  
ANSWERS IN SUBSET # 3  
18 DOCUMENTS IN RESULT  
  
.subset 0  
  
.look 'heat transfer'  
.look not <au> = 'McCoy'  
.end  
SEARCHING SUBSET # 0  
ANSWERS IN SUBSET # 4  
22 DOCUMENTS IN RESULT
```

Example 5

Search Strategy for Browsing

```
.look <h> = 'fb'
```

```
.look <h> = 'fc'
```

```
.end
```

```
SEARCHING SUBSET # 0  
ANSWERS IN SUBSET # 6  
39 DOCUMENTS IN RESULT
```

```
.look <ke> = 'ductility' <ke> = 'heat treatments'
```

```
.end
```

```
SEARCHING SUBSET # 6  
ANSWERS IN SUBSET # 7  
9 DOCUMENTS IN RESULT
```

```
.subset 0
```

```
.look <ke> = 'heat transfer'
```

```
.look not <pub> = 'Oak Ridge'
```

```
.end
```

```
SEARCHING SUBSET # 0  
ANSWERS IN SUBSET # 8  
2 DOCUMENTS IN RESULT
```

```
.list au,ti
```

```
**** SUBSET # 8 ****
```

```
### 111 ###
```

```
<AUTHOR >Gat, U.
```

```
<TITLE >COOLING CONCEPTS FOR A COMPACT MOSEL (MOLTEN SALT) REACTOR
```

```
### 366 ###
```

```
<AUTHOR >Voznick, H.P.; Uh1, V.W.
```

```
<TITLE >MOLTEN SALT FOR HEAT TRANSFER
```

```
*** END LIST
```


Example 6

Preparation and Combination of Subsets

```
.look <ke> = 'corrosion'

.end
SEARCHING SUBSET # 0

373 DOCUMENTS IN FILE
ANSWERS IN SUBSET # 1
69 DOCUMENTS IN RESULT

.look <ke> = 'MSRE'

.end
SEARCHING SUBSET # 1
ANSWERS IN SUBSET # 2
41 DOCUMENTS IN RESULT

.subset 0

.look <ke> = 'Hastelloy'

.end
SEARCHING SUBSET # 0
ANSWERS IN SUBSET # 3
84 DOCUMENTS IN RESULT

.combine 2 and 3
ANSWERS IN SUBSET # 4
24 DOCUMENTS IN COMBINED RESULT

.combine 2 or 3
ANSWERS IN SUBSET # 5
101 DOCUMENTS IN COMBINED RESULT

.combine 2 not 3
ANSWERS IN SUBSET # 6
17 DOCUMENTS IN COMBINED RESULT

.combine 3 not 2
ANSWERS IN SUBSET # 7
60 DOCUMENTS IN COMBINED RESULT

.subset 4

.print
PRINTED

.stop
```

Example 7Summary Tabulation of Commands Used
During an ORLOOK Session

. request

```

-----
:RESULT:SEARCH: NO.: DEFAULT: SEARCH ITEM(S) OF REQUEST(S):
: IN # :FROM #: HITS: LABELS :
-----
: 1: 0: 1: ALL : LOOK <KE> = 'HEAT TRANSFER' :
: : : : : AND <KE> = 'LIQUID METALS' :
: 2: 0: 35: ALL : LOOK <KE> = 'HEAT TRANSFER' :
: : : : : LOOK <KE> = 'LIQUID METALS' :
: 3: 0: 18: ALL : LOOK <KE> = 'HEAT TRANSFER' :
: : : : : LOOK NOT <KE> = 'LIQUID META:
: : : : : LS' :
: 4: 0: 22: ALL : LOOK 'HEAT TRANSFER' :
: : : : : LOOK NOT <AU> = 'MCCOY' :
: 5: 4: 0: ALL : LOOK <H> = 'FB' :
: : : : : LOOK <H> = 'FC' :
: 6: 0: 39: ALL : LOOK <H> = 'FB' :
: : : : : LOOK <H> = 'FC' :
: 7: 6: 9: ALL : LOOK <KE> = 'DUCTILITY' <KE:
: : : : : > = 'HEAT TREATMENTS' :
: 8: 0: 2: ALL : LOOK <KE> = 'HEAT TRANSFER' :
: : : : : LOOK NOT <PUB> = 'OAK RIDGE':
-----

```

Example 8

Labels Available in ORLOOK Procedure

.labels

LABELS(ABBREV)	MODE	TYPE
HEADER(H)	TEXT	LIST*
AUTHSHIP(AUT)	TEXT	SUBSET*
AUTHOR(AU)	TEXT	LIST*
CORPAUTH(COR)	TEXT	LIST
SPONSOR(SP)	TEXT	LIST
MENTOR(M)	TEXT	LIST
TITLE(TI)	TEXT	LIST*
REFERENC(R)	TEXT	SUBSET*
LIT TYPE(LI)	TEXT	LIST
PUB DATE(PU)	TEXT	LIST*
PUB DESC(PUB)	TEXT	LIST
LANGUAGE(L)	TEXT	LIST
COUNTRY(COU)	TEXT	LIST
AVAIL(AV)	TEXT	LIST
OR AVAIL(O)	TEXT	LIST
SEC SOUR(S)	TEXT	LIST
KEYTERMS(K)	TEXT	SUBSET*
SUBJ CAT(SU)	TEXT	LIST*
KEYWORDS(KE)	TEXT	LIST*
GEOGDESC(G)	TEXT	LIST
DATADATE(DA)	TEXT	LIST
TAXON(T)	TEXT	LIST
PARMLIST(P)	TEXT	LIST
PVT KWD(PV)	TEXT	LIST
TAXON 2(TA)	TEXT	LIST
CHEMICAL(C)	TEXT	LIST
ABSTRACT(A)	TEXT	LIST*
COMMENT(CO)	TEXT	LIST
INPUTEAM(I)	TEXT	LIST
DATA FLD(D)	TEXT	SUBSET
DATADESC(DAT)	TEXT	LIST
NUM DATA(N)	TEXT	LIST

.stop
END ORLOOK SESSION

CPU(SEC) USED = 52.66 LAPSED (HR.MIN.SEC) = 00.48.10
TIME NOW = 14.51.50

* Asterisks added to identify LABELS used in MSRIS.



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