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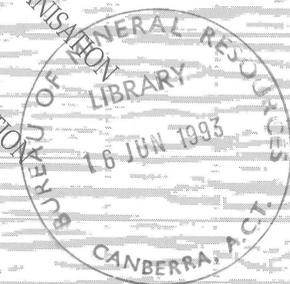
# NUCEXP: Nuclear Explosions Database Users' Manual

by

*S L Lenz*

## RECORD 1993/39

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(LENDING SECTION)



**NUCEXP  
NUCLEAR EXPLOSIONS DATABASE  
USERS' MANUAL**

**S. L. Lenz**

**AGSO Record 1993/39  
May 1993**



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## DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

Minister for Resources: The Hon. Michael Lee  
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## AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

Executive Director: Roye Rutland

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## ABSTRACT

This manual describes the structure of NUCEXP, the Nuclear Explosions Database. Details of how to insert, update or delete records in the database are presented together with a description of the reports that can be used to retrieve subsets of the data.

## 1. INTRODUCTION

The Nuclear Monitoring Section of the Australian Seismological Centre (ASC), Australian Geological Survey Organisation (AGSO), was created out of a Government initiative in 1984. It operates a national facility for the seismological detection and identification of underground nuclear explosions and contributes as a seismic data centre to international endeavours to attain a Comprehensive Nuclear Test Ban Treaty. Information on the detection of underground nuclear explosions is released publicly. The Nuclear Monitoring Section has compiled a listing of all detected and recorded nuclear explosions since 1945.

This Nuclear Explosions Database was originally set up in Ingres on a Sun workstation. In 1990 the database was transferred to ORACLE, the relational database management system (RDBMS) on the corporate DG MV20000 computer, and in August 1992 to the new corporate database server, a DG AViiON 6240.

## 2. STRUCTURE OF THE DATABASE

### 2.1 The relational model

The Nuclear Explosions Database resides on AGSO's database server in the ORACLE RDBMS's production environment. Because relational database terms are used inconsistently in the literature (Brathwaite, 1989, p. 66) short definitions of the terms used in this manual are given here. A glossary of database terms is given in section 7.

In the relational database model we talk about **data entities** and the **relationships** between these entities. The basic (and only) unit of data storage in a relational database is the **table**, a two-dimensional grid of columns and rows. An **entity** is any distinguishable object that is to be represented in the database as one or more tables. Every table within the database is defined with a name and a set of columns. The **attributes** which characterise the entity are the columns in the table. Each column is given a name, a data type, and a width. The distinct instances or occurrences of the entity, the so-called **records** or table rows, each have a certain set of attribute values.

Relational databases are firmly based on mathematical set theory and relational algebra. Operators like UNION, INTERSECT and DIFFERENCE can be used to create new tables from existing ones. The **relationships** between entities are logical links between them which can be used to associate data in one table with related data items in another. This is usually done by "joining" two tables through data values which are common to both tables.

If one record in a table relates to a single record in another table we talk of a **one-to-one** relationship. Similarly, if one record in the first table corresponds to more than one record in the second table, we are looking at a **one-to-many** relationship. Finally, a **many-to-many** relationship occurs when several records in the first table correspond to more than one record in the second table. In the NUCEXP database tables XSITES and XSOURCES have one-to-many relationships to table EXPLOSIONS (see below).

A **key** within a table is an attribute (column) or attributes whose values uniquely identify each record (row). For instance, in the NUCEXP database the record number (*recno*) is the key to the EXPLOSIONS table (see below). **Indexes** can be used to speed up execution of transactions and, in the case of "unique indexes", to guarantee uniqueness of records.

## 2.2 Database tables

NUCEXP comprises three tables for the following data entities: explosion details, sites of explosions, and sources of information (see Appendix A: Logical Data Structure). Two of these tables are lookup tables: table XSITES contains a list of all the explosion sites, and table XSOURCES contains a list of the publications or other sources of information on nuclear explosions. The main table is called EXPLOSIONS and it contains all the available information on a particular explosion: date, time, location, yield range, body wave and surface wave magnitudes, as well as short comments. Site and source codes refer to entries in the XSITES and XSOURCES lookup tables. The database schema (Appendix B) contains a description of the tables and their attributes, and the relationships between them.

## 3. NUCEXP IN ORACLE

### 3.1 ORACLE tools and utilities

The ORACLE relational database management system may be accessed via the **Structured Query Language (SQL)**. There are four different types of SQL statements:

<u>statement type</u>	<u>example</u>
data definition	CREATE TABLE...
data control	GRANT SELECT...
data manipulation	INSERT...
data query	SELECT * FROM...

The data definition and data control statements are used when setting up, or changing the structure of, the database, and for controlling data access. These are tasks performed by the database owner. Data manipulation and data query statements are used for inserting, updating and deleting records as well as for data retrieval.

**SQL\*Plus** is an extended version of SQL which provides some limited report formatting in addition to the standard SQL functions.

The data manipulation and data query statements, and some of the data control statements, are invoked from within **SQL\*Forms** without the user of NUCEXP having to learn the SQL syntax. SQL\*Forms is a full-screen interface tool for creating, modifying and using forms for data entry and retrieval in an ORACLE database. Records may also be updated or deleted through SQL\*Forms (see Chapter 4: Querying/Updating the database).

**SQL\*Menu** and with it **PL/SQL** which combines procedural capabilities with the SQL language have been used to set up a menu front end for NUCEXP to provide access to the data entry/query forms and the SQL and **Structured Query Report Writer (SQR)** reports.

**SQL\*Loader** is an ORACLE tool that was used to load data from ASCII files on the DG MV20000 into ORACLE tables after the data had been extracted from the ASC Ingres database.

The utilities **EXPORT** and **IMPORT** can be used by the database owner to transfer the database to and from operating system files (e.g. for backups).

For more detailed information on the use of these tools and utilities refer to the user guides and reference guides listed in Chapter 6: References.

### 3.2 The NUCEXP menu

It is assumed that NUCEXP users are already familiar with the AViiON and its operating system Unix, and also have some basic knowledge of SQL.

In order to access the database and use the NUCEXP forms the prospective user must be registered as an AViiON user AND an ORACLE user with respective usernames and passwords. On AGSO's AViiON, all forms and files for accessing NUCEXP reside in a directory called /home/nucexp. Any AViiON user with an ORACLE logon may read or execute the forms, the report files etc. through the NUCEXP menu as the public has been granted SELECT privilege to all tables. Tablenames have to be prefixed with the name of the owner ('NUCEXP.'), when being queried through the SQL\*Plus option.

Keyboard **keys** are referred to by their SQL\*Forms and SQL\*Menu **functions**. In this manual they are in bold face and upper case, as well as being enclosed in angle brackets. The available functions are different in menu, query and entry mode. A listing of the available functions within SQL\*Menu and SQL\*Forms can be displayed on the screen by pressing the key called **<SHOW FUNCTION KEYS>**.

To access NUCEXP, log on to the AViiON, specify the terminal type being used, and type

**nucexp**

or **nucexpsun** if your terminal is a Sun workstation.

As the menu system is entered, you are prompted for your ORACLE username and password. On the same screen is an alert to the actual key or key combination on your present terminal which has the function of **<SHOW FUNCTION KEYS>**.

Take note of the key or key combination for accessing the lists of available function keys!

The following menu will come up on your screen:

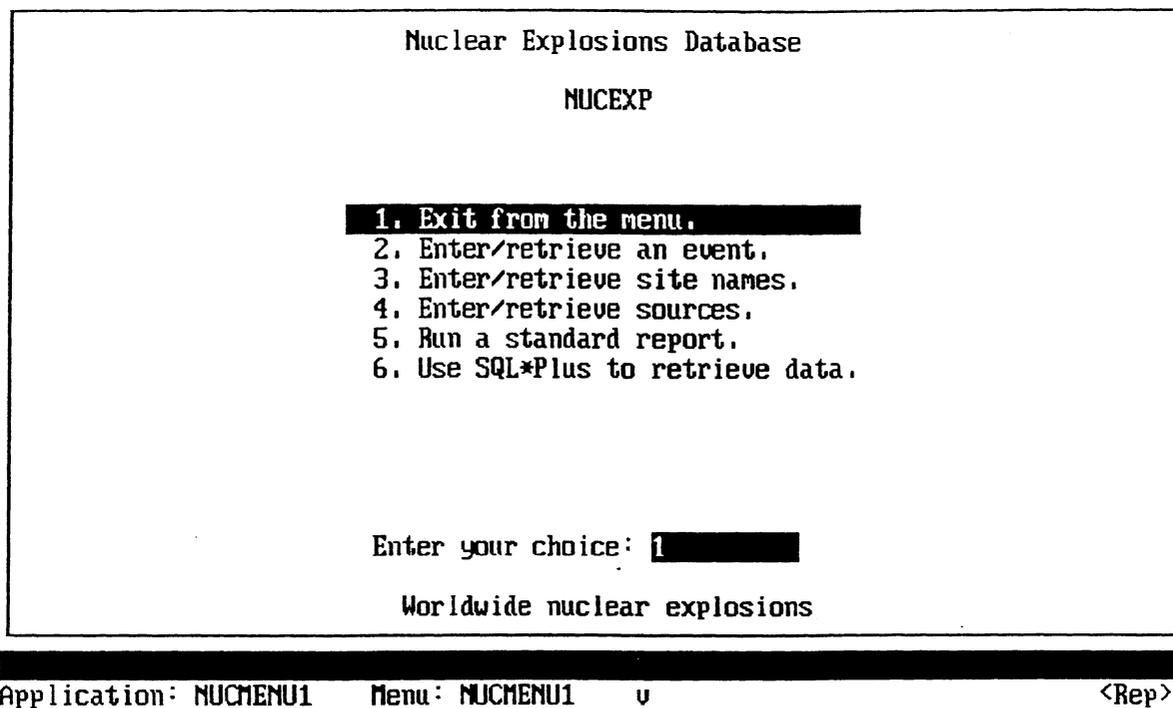


Figure 1. The NUCEXP main menu.

The individual menu options are discussed in chapters 4 and 5.

To exit the menu and return to the Unix prompt, choose menu item 1 or press **<EXIT/CANCEL>**.

## 4. QUERYING/UPDATING THE DATABASE

### 4.1 Using SQL\*Forms

#### 4.1.1 General comments

Three data entry/query forms have been set up for use with the NUCEXP database (menu options 2 - 4). They are discussed individually under 4.1.2 to 4.1.4. Following is a general description of how to use the forms.

The forms correspond to different tables (= base tables) in the database. Thus, forms EXPLOSIONS, XSITES and XSOURCES correspond to tables of the same names. Each screen (or **block** in SQL\*Forms terminology) displays data from several records.

The **cursor** generally moves within the screen from left to right and from top to bottom. Watch the **message line** at the bottom of the screen closely as you move through the fields using the **<NEXT FIELD>** key to go forwards and the **<PREVIOUS FIELD>** key to go backwards. It displays help messages for data entry and error messages should something go wrong. There is also a **<DISPLAY ERROR>** key that gives additional information on errors which have occurred.

Some fields are **mandatory** which means a valid value must be entered before the cursor can move out of the field. Look at the help message or the database schema (Appendix B) if you are uncertain about the data type for a particular field.

Should you realise after leaving a field that you have made a mistake while entering data, you can always take the cursor back by pressing the **<PREVIOUS FIELD>** key. Correct the mistake by typing over it.

Users should save the added/updated record/s to the database ("commit" the data by pressing the key called **<ACCEPT/COMMIT>**) before exiting the form. The message "**n records posted and committed**" indicates that changes have been committed to the database. If you attempt to leave the form without having committed updates or new entries, you will be asked whether you want to "**commit the changes you have made**" with the option of choosing yes or no or cancelling the exit. Choose no if you are unsure about the changes, and cancel if you want to go back into the form to check on any changes you have made.

**QUERYING THE DATABASE:** Access the appropriate form by entering the corresponding number on the menu. To retrieve all records which satisfy certain conditions, press **<ENTER QUERY>** and then enter the values of the attributes (fields) which you are interested in, moving from field to field by using the **<NEXT FIELD>** and **<PREVIOUS FIELD>** keys. Pressing **<EXECUTE QUERY>** will result in the record/s which satisfy your query criteria being displayed on the screen. To scroll through the records use the **<NEXT RECORD>** and **<PREVIOUS RECORD>** keys.

**DELETING RECORDS:** If a record has to be deleted, use the above procedure to call it up on the screen and then press **<DELETE RECORD>**. **Caution:** Make sure the cursor is really positioned on the record you want to delete before pressing the delete key.

**UPDATING RECORDS:** To update or make changes to a record, use the above procedure to display it on the screen and then place the cursor in the field you want to update or change. Make the necessary amendments to the field/s using the editing keys (e.g. **<LEFT ARROW>**, **<RIGHT ARROW>**, **<DELETE>** and **<INSERT/REPLACE>**) and by typing over the existing field value.

**ENTERING NEW RECORDS:** After highlighting number 2 on the menu and pressing **<ENTER>**, the cursor enters the empty EXPLOSIONS block. A new record can be entered straight away by typing values into all fields for which data exist. Press **<ACCEPT/COMMIT>** to add the record to the database. If the block already contains data, press **<CREATE RECORD>** to clear the next record ready for entering a new one.

When entering the XSITES or XSOURCES forms (menu options 3 and 4) all sites and publications (sources) are retrieved from the database. To add a new record, scroll through the records (pressing **<NEXT RECORD>** or **<NEXT SET OF RECORDS>**) until the cursor enters the first empty code field. Type in the code, then the description and press **<ACCEPT/COMMIT>** to add the new record to the database. Alternatively, press **<CREATE RECORD>** to clear the next row ready for entering a new record.

#### 4.1.2 The EXPLOSIONS form - menu option 2

From the NUCEXP opening menu (p. 4) choose option 2. The following form will appear on the screen (without data):

```

      NUCEXP - Nuclear Explosions Database
-----
Recno  Group  *?  Date  Origin time  nb  Ms  Yield  Site
1      5      | 450716  |         | 19  | to  | TISC
Lats  .000  | Longs  .000  | Source NRDC  | Comments New Mexico. atnos
-----
2      5      | * 450716  |         | 19  |     | TISC
Lats  .000  | Longs  .000  | Source USAEC  | Comments "trinity"NewMex.atms
-----
3      5      | 450716  | 123000.0  |     | 19  |     | TISC
Lats  .000  | Longs  .000  | Source GLAS   | Comments New Mexico atnos
-----
4      10     | 450805  |         |     | 15  |     | TISC
Lats  .000  | Longs  .000  | Source NRDC   | Comments "little boy"Japan at
-----
5      10     | 450805  | 231500.0  |     | 20  |     | TISC
Lats  .000  | Longs  .000  | Source GLAS   | Comments Japan atnos
-----
5      10     | * 450805  |         |     | 13  |     | TISC
Lats  .000  | Longs  .000  | Source USAEC  | Comments Hiroshima,Jap.atnos
Press <ENTER QUERY>, <EXECUTE QUERY>; <COMMIT>; <EXIT> to return to menu.
-----
Enter the group ID number.
Count: 6          0                                     <Replace>
  
```

Figure 2. The EXPLOSIONS form.

Six records can be displayed simultaneously on the screen. To retrieve data, press **<ENTER QUERY>** and input your selection criteria, e.g. an individual record number, a specific date, an individual source code etc., or a combination of any of the attributes. Pressing **<EXECUTE QUERY>** will retrieve the records that satisfy the specified condition/s.

To specify a range of record numbers, say, or a range of dates, press **<ENTER QUERY>** and enter a '&' into any field and then press **<EXECUTE QUERY>**. A pop-up window will be displayed in the middle of the screen prompting for the conditions of the WHERE clause (see also 4.2). Enter e.g. **'XDATE BETWEEN 800101 AND 800610'** to retrieve all the explosions between the first of January and the tenth of June 1980, and press the **<ACCEPT/COMMIT>** key which results in the specified retrieval. Note that the database fieldnames have to be used here, **not** the names on the screen and that values for alphanumeric fields have to be entered exactly as contained in the database (see Appendix B for fieldnames and Appendix E for site and source codes).

To specify a more complex WHERE clause, e.g. a combination of a range of dates, a range of sites and a range of body wave magnitudes, press **<ENTER QUERY>** and then enter short substitutes for the fieldnames into the fields to be selected on, in the form of '**&A**', '**&B**', '**&C**' etc. Press **<EXECUTE QUERY>**. In the WHERE clause in the pop-up window you can now use the substitutes in place of the fieldnames. Thus,

where           **&A between 800101 and 800610**  
                  **and &B in ('EKaz','Ural')**  
                  **and &C between 3 and 4**

with &A in date, &B in site and &C in mb magnitude will result in the same retrieval as the WHERE clause

where           **xdate between 800101 and 800610**  
                  **and site in ('EKaz','Ural')**  
                  **and mb between 3 and 4.**

When adding new records with this form, the cursor cannot enter the *recno* field. A unique number is generated for this field from a sequential number generator (a so-called sequence, see Appendix B) at commit time.

### 4.1.3 The XSITES form - menu option 3

From the NUCEXP opening menu (p. 4) choose option 3. The following form will appear on the screen displaying the codes and descriptions of 15 nuclear explosion sites.

```
----- NUCEXP - Nuclear Explosions Database -----  
  
Site Description  
Bik Bikini Island (USA)  
CKaz Central Kazakhstan, USSR  
ChI Christmas Is.(USA)  
EKaz Eastern Kazakhstan, USSR  
Ene Enewitok (USA)  
Fang Fangataufu  
JoI Johnson Is. area (USA)  
LopN Lop Nor, Sinkiang Province, China  
MISC Miscellaneous - specify under 'comment'  
Mbl Monte Bello Is.(UK)  
Mur Mururoa Atoll, Tuamotu Archipelago (Fr)  
NTS Nevada Test Site, USA  
NovZ Novaya Zemlya, USSR  
USSR specify under 'comment'  
Ural Ural Mountains, USSR  
  
Enter an abbreviation for the site.  
Count: *15 <Replace>
```

Figure 3. The XSITES form.

Scroll through the records displayed by pressing **<NEXT RECORD>** or **<NEXT SET OF RECORDS>** to move forwards through the retrieved list, and **<PREVIOUS RECORD>** to go back. When adding new records make sure that the character string entered in the *site* field is unique. A full listing of the current contents of table XSITES can be retrieved by running option 9 on the SQL\*Plus submenu (see also Appendix E).

#### 4.1.4 The XSOURCES form - menu option 4

From the NUCEXP opening menu (p. 4) choose option 4. The following form will appear on the screen displaying the codes and descriptions of 15 sources of information on nuclear explosions.

```
----- NUCEXP - Nuclear Explosions Database -----
Source  Description
APTA    American Peace Test Alerts
ASAR    Alice Springs seismic array
ASPA    Alice Springs seismic station
BOCH    Bocharov et al,1989 list as in Vergino,E.S.:Soviet Test Yiel
BOLT    Bolt, B.A., 1976, Nuclear Explosions and Earthquakes. The Pa
CSS     Center for Seismic Studies, USA
CTAO    Charters Towers seismic station
DAHL    Dahlman, O. & Israelson, H., 1977. Monitoring Underground Nu
FOA     Seismology (Yearly Reports), FOA Reports, Sweden
GLAS    Glasstone: The Effects of Nuclear Weapons. 1964
ISC     International Seismological Centre, UK
MISC    Miscellaneous
NAO     Norsar seisnic array
NDRI    telex from National Defence Research Institute, Sweden
NRDC    Known US Nuclear Tests: July 1945 - 31 Dec 1987 by Norris, C

Enter abbreviation for the source.
Count: 15          u                                     <Replace>
```

Figure 4. The XSOURCES form.

Scroll through the records displayed by pressing **<NEXT RECORD>** or **<NEXT SET OF RECORDS>** to move forwards through the retrieved list, and **<PREVIOUS RECORD>** to go back. When adding new records make sure that the character string entered in the *source* field is unique. A full listing of the current contents of table XSOURCES can be retrieved by running option 9 on the SQL\*Plus submenu (see also Appendix E).

## 4.2 Using SQL\*Plus - menu option 6

Any registered ORACLE user can query the NUCEXP database through SQL\*Plus as the public has been granted SELECT privileges to all tables. But only members of the ASC have the right to INSERT, UPDATE or DELETE data in the database.

To run your own SQL\*Plus retrieval, choose option 6 on the NUCEXP opening menu (p. 4), then option 1 on the SQL\*Plus submenu. The SQL prompt in the production environment is SQL-prod>.

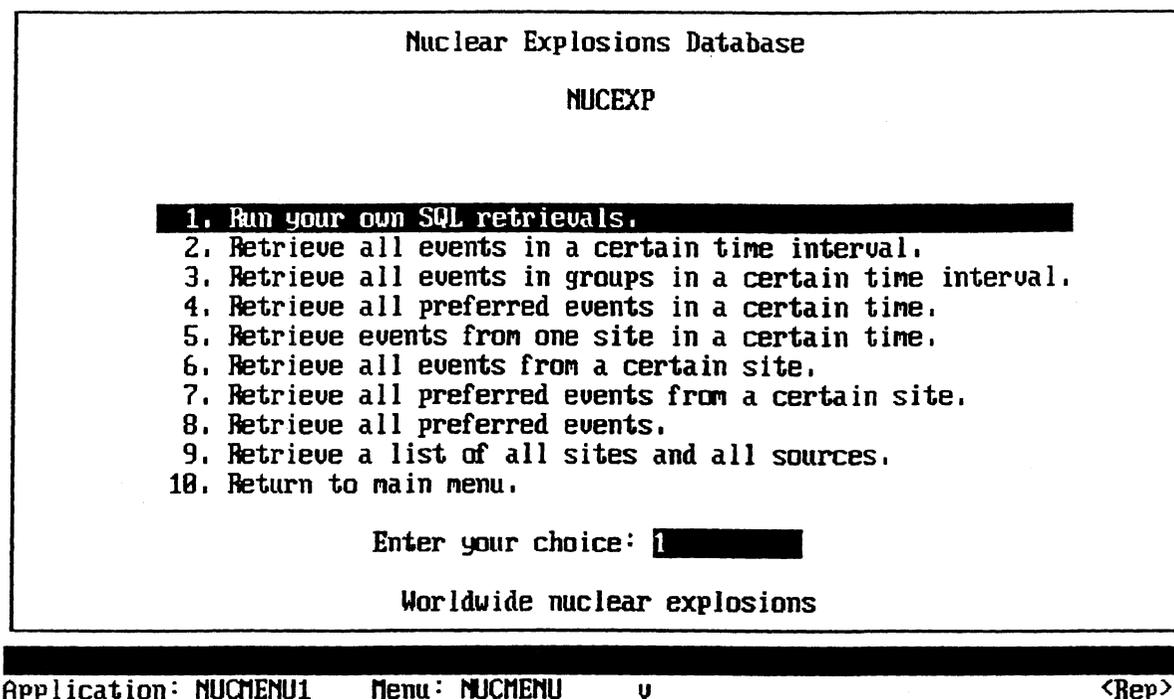


Figure 5. The SQL\*Plus submenu.

The general statement for retrieving data is

```
SELECT column FROM table
WHERE condition;          (optional)
```

For instance, to retrieve all the records from the XSOURCES table, at the SQL> prompt type:

```
SELECT * FROM NUCEXP.XSOURCES;
```

or to retrieve date, origin time, latitude, longitude and yield of all explosions on site Eastern Kazakhstan type:

```
SELECT XDATE,ORIGIN_TIME,LATS,LONGS,YIELD1,YIELD2  
FROM NUCEXP.EXPLOSIONS  
WHERE SITE = 'EKaz';
```

ORACLE accepts lower OR upper case commands. Only in relation to character field values is ORACLE case sensitive, i.e. site and source codes have to be entered exactly as in the database (see Appendix E for codes) and enclosed in single quotes.

Combinations of conditions are also possible:

```
SELECT XDATE,ORIGIN_TIME,LATS,LONGS,YIELD1,YIELD2  
FROM NUCEXP.EXPLOSIONS  
WHERE XDATE BETWEEN 450101 AND 501231  
AND SITE = 'EKaz';
```

SQL\*Plus can also be used by ASC staff to insert new records, and to update or delete existing ones.

For example, a new source record can be created by typing at the SQL> prompt:

```
INSERT INTO NUCEXP.XSOURCES(source,description)  
VALUES ('Ans', 'A new source');
```

or a record in the sites table can be changed in the following way:

```
UPDATE NUCEXP.XSITES  
SET DESCRIPTION = 'Ural Mountains, Russia'  
WHERE SITE = 'Ural';
```

To commit the new or updated record to the database, type

```
COMMIT;
```

or, if you have made a mistake, type

```
ROLLBACK;
```

Type **EXIT** to return to the menu.

For more information on SQL and SQL\*Plus refer to the SQL Language Reference Manual and the SQL\*Plus User's Guide and Reference (Chapter 6: References).

From within SQL\*Plus Unix commands on the database server can be executed by typing **host unix-command** at the SQL prompt, e.g. **host ls** produces a listing of the working directory without exiting SQL\*Plus.

Options 2 to 9 on the SQL\*Plus submenu allow the user to run several SQL scripts which retrieve subsets of the data in table EXPLOSIONS (items 2 - 8) and the contents of tables XSITES and XSOURCES (item 9). The data are retrieved and stored in files in the user's home directory from where they can be sent to the printer.

The output filenames are:

option 2:	dateall.lst
option 3:	dateallgrp.lst
option 4:	datepref.lst
option 5:	sitedate.lst
option 6:	siteall.lst
option 7:	sitepref.lst
option 8:	prefall.lst
option 9:	sitesource.lst.

After entering the appropriate number and pressing **<ENTER>** the user is prompted for entry of start date and end date for the retrieval (format: YYMMDD, e.g. 801201) and/or the abbreviation for the site (see Appendix E for a list of site codes). Options 8 and 9 do not prompt for any input as they retrieve all values in the respective tables.

Only one report of the same kind can be run in one session as the same name is used for the output file every time the retrieval is run, i.e. an existing file with that name will be overwritten. To run several retrievals of the same kind, the previous output file has to be renamed - either from within SQL\*Plus (menu option 1) using the **host mv oldfile newfile** command (see above) or from the Unix prompt.

The scripts for these retrievals are contained in Appendix C.

## 5. PRODUCING STANDARD REPORTS - menu option 5

An SQR report program for retrieving details on nuclear explosions from the database has been set up (see Appendix C for the script of this report program). The user can input values for certain attributes to limit the retrieval to subsets of the database, and also has the option of entering an additional WHERE clause containing any condition or combination of conditions desired for the retrieval.

To run the report, choose option 5 on the NUCEXP opening menu (p. 4). The following selection menu will appear on your screen:

```
Selection menu for extracting information on nuclear
explosions from the AGSO-ASC Nuclear Explosions Database
NUCEXP
```

```
1 - start date.....
2 - end date.....
3 - test site code.....
4 - other conditions:
```

```
      G - Go          X - Exit
```

```
Enter a number to change retrieval conditions or G/X :
```

Figure 6. The report selection menu.

The default settings for a report run retrieve ALL **preferred** records from ALL sites. They are put out to a file in your directory called *explode.lis*.

Choose option :

- 1 and 2      to enter the start and end date of the time period you are interested in; **both** have to be entered;
- 3            to specify a particular test site; enter the **code** from the list of sites (Appendix E);
- 4            to specify search criteria in addition to the above.

For instance, you might be interested in the nuclear explosions detonated in both East and Central Kazakhstan in the 1970s. Press 1 to enter **700101**; 2 to enter **791231**; and 4 to enter the following condition: **site in ('EKaz','CKaz')**. Enter **G** (upper OR lower case) to start the retrieval. After completion of the retrieval the menu will refresh and you will again be prompted for input. Enter **X** (again, upper OR lower case will work) to exit the selection menu. The output file *explode.lis* resides in your home directory and can be sent to the printer after exiting the NUCEXP menu.

The report can NOT be run multiple times in one session as the same filename is used for the output every time the retrieval is executed (that means the output file is overwritten). Change the previous run's filename with the command **mv oldfile newfile** at the Unix prompt before the report is run again.

## 6. REFERENCES

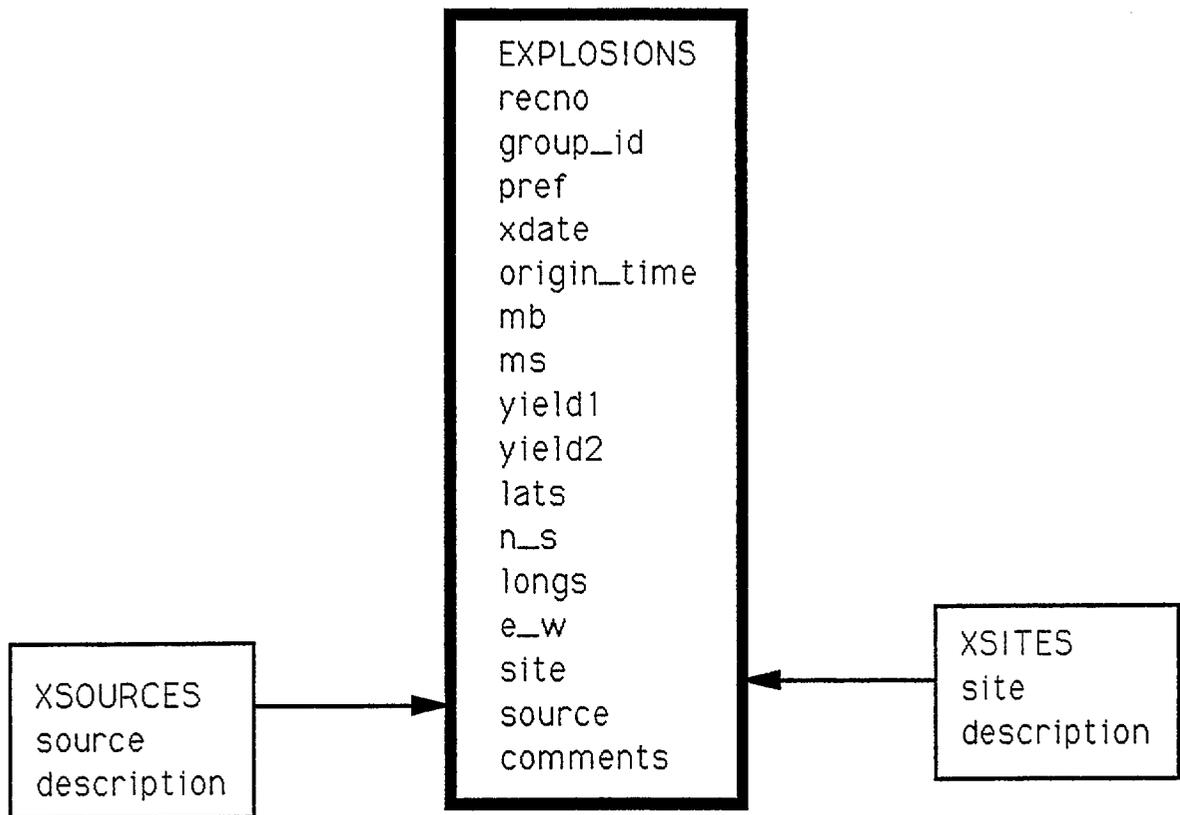
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## 7. GLOSSARY OF DATABASE TERMS

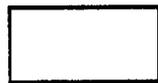
- ASCII** American Standard Code for Information Interchange;
- ATTRIBUTE** column in a database table;
- BACKUP** duplicate of database objects which enables them to be restored later to the state they were in at the time of backup;
- COLUMN** fields representing one kind of data (one attribute) in a table;
- COMMIT** SQL\*Plus command for storing (making permanent) changes made to database tables;
- CREATE** SQL command for setting up new database objects;
- DATABASE SCHEMA** SQL script for creating all objects of a database including a detailed description of the objects and their data items;
- DELETE** SQL command to remove rows from a table;
- ENTITY** distinguishable system object represented in the database;
- EXPORT** ORACLE utility for moving database objects and data to operating system files;

GRANT	assign access rights to a database user;
IMPORT	ORACLE utility for moving exported database objects and data back into the database;
INDEX	database object that enables finding a specific row without examining the whole table;
INSERT	SQL command for adding new rows to a table;
JOIN	retrieve parts of a row from two or more tables at the same time;
KEY	column/s in a table whose values uniquely identify the records in that table;
ORACLE RDBMS	relational database management system sold by Oracle Corporation;
PL/SQL	programming language that extends SQL by adding procedural capabilities;
RDBMS	data storage and retrieval program which organises data into tables whose rows all have the same set of data items (columns);
RECORD	data in one row of a table; instance of an entity;
ROLLBACK	SQL*Plus command to discard changes made to tables before they have been committed;
SELECT	SQL command to retrieve data from one or more tables and/or views;
SEQUENCE	database object used to generate unique integers for use as primary keys;
SQL	<b>Structured Query Language</b> ; user interface for manipulating a database;
SQL*FORMS	interface tool for creating, modifying and using forms to access an ORACLE database;
SQL*LOADER	tool for loading data from ASCII files into an ORACLE database;
SQL*PLUS	extension of SQL for producing formatted reports from an ORACLE database;
SQR	<b>Structured Query Report Writer</b> ; used for accessing relational databases;
TABLE	grid of columns and rows; basic unit of data storage in an RDBMS;
UPDATE	SQL command for changing values of fields in a table;
UTILITY	program run by an operating system command to perform functions associated with ORACLE;
WHERE	clause in SQL to specify conditions for an operation on a relational database.

# APPENDIX A: LOGICAL DATA STRUCTURE



main table



lookup table



one-to-many relationship

nucexp1

## APPENDIX B: DATABASE SCHEMA

rem SCHEMA FOR THE NUCLEAR EXPLOSIONS DATABASE NUCEXP date: 21.08.92

rem Written by: S. Lenz, BMR Information Systems Branch

rem The Nuclear Monitoring Section of the Australian Seismological Centre  
rem has compiled a listing of detected and recorded nuclear explosions.  
rem This nuclear monitoring database was originally set up in INGRES on a  
rem SUN workstation and transferred to ORACLE on the DG MV20000 in October 1990.  
rem In August 1992 it was transferred to the corporate database server, a DG AViiON 6240.  
rem It contains two lookup tables, one for the geographical location of nuclear explosions  
rem (XSITES), the other one for sources of data (XSOURCES). The third table  
rem (EXPLOSIONS) contains selected data items on the explosions.

rem This schema contains the SQL statements for creating the tables and any  
rem necessary indexes as well as a description of the data fields:

```
create table XSITES      (site          char(4) not null primary key,  
                        description    char(50) not null)  
                        tablespace TBSPB  
                        storage (initial 4K next 2K);
```

rem The two fields in this table contain a unique abbreviation and a full  
rem description of the sites of nuclear explosions.

```
create table XSOURCES   (source        char(5) not null primary key,  
                        description    char(150) not null)  
                        tablespace TBSPB  
                        storage (initial 4K next 2K);
```

rem These two fields contain a unique abbreviation and a full reference of  
rem the sources of the data on nuclear explosions.

```
create table EXPLOSIONS (recno        number(5) not null primary key,  
                        group_id      number(5) not null,  
                        pref          char(1),  
                        xdate         number(6) not null,  
                        origin_time   number(7,1),  
                        mb            number(2,1),  
                        ms            number(2,1),  
                        yield1        number(7,3),  
                        yield2        number(7,3),  
                        lats          number(5,3),  
                        n_s           char(1),  
                        longs         number(6,3),  
                        e_w           char(1),  
                        site          char(4) not null references XSITES(site),  
                        source        char(5) not null references XSOURCES(source),  
                        comments      char(25))  
                        tablespace TBSPB  
                        storage (initial 310K next 10K);
```

```
rem create unique index EXPLOS1 on EXPLOSIONS (recno);  
rem create index EXPLOS2 on EXPLOSIONS (group_id);  
rem create index EXPLOS3 on EXPLOSIONS (xdate,origin_time);  
rem create index EXPLOS4 on EXPLOSIONS (site);  
rem create index EXPLOS5 on EXPLOSIONS (pref);
```

rem This is the data table for the nuclear explosions monitoring database.  
rem The recno is a system-generated sequential number which is the unique  
rem identifier for the records in this table.  
rem The group\_id is a number field which groups together all the records  
rem obtained for one explosion.  
rem Field pref indicates with an "\*" which record within a group is the  
rem one preferred for publication, general enquiries etc.  
rem Field xdate contains the date of the explosion in the format: 901015  
rem (= October 15, 1990).  
rem Origin\_time contains the time of the explosion in the format: hhmmss.s  
rem (two digits for the hour, two digits for the minutes, and two digits  
rem and one decimal for the seconds).  
rem Body wave magnitude and surface wave magnitude are entered in fields mb  
rem and ms.  
rem The range of yield of the explosion in kt is contained in fields yield1  
rem and yield2. If only one value is known field yield2 stays empty.  
rem The values for latitude and longitude are entered into fields lats and  
rem n\_s, and longs and e\_w.  
rem The abbreviations for the geographical location of the explosion  
rem (site) and the source of the information (source) are taken out of  
rem tables XSITES and XSOURCES.  
rem Additional comments go into field comments.

rem Indexes are to be created later.

rem A sequence is used for generating sequential numbers for field recno in  
rem table EXPLOSIONS. This sequence is called XSEQ.

rem Space allocation for NUCEXP:

rem tablename	XSITES	XSOURCES	EXPLOSIONS
rem record size	54	155	76
rem # of records	14	21	4000
rem required space	756bytes	3255bytes	304kbytes
rem initial storage	4K	4K	310K
rem next	2K	2K	10K
rem minextents	1	1	1
rem maxextents	9999	9999	9999
rem pctincrease	0	0	0

## APPENDIX C: REPORT SCRIPTS

### File sitepref.sql

```
set pagesize 999
set linesize 120
column recno heading '#' format 99999
column group_id heading 'Group' format 99999
column pref heading ' ' format a1
column xdate heading 'Date' format 999999
column origin_time heading 'Time' format 999999.9
column mb heading 'mb' format 9.9
column ms heading 'ms' format 9.9
column yield1 heading 'Yield' format 9999.999
column yield2 heading 'to' format 9999.999
column lats heading 'Lats' format 99.999
column n_s heading ' ' format a1
column longs heading 'Longs' format 999.999
column e_w heading ' ' format a1
column site heading 'Site' format a4
column source heading 'Source' format a5
column comments heading 'Comments' format a20
spool sitepref
select * from nucexp.explosions
      where site = '&site_code__as_in_the_code_list'
      and pref = '*'
      order by xdate;
spool off
exit
```

### File sitedate.sql

```
set pagesize 999
set linesize 120
column recno heading '#' format 99999
column group_id heading 'Group' format 99999
column pref heading ' ' format a1
column xdate heading 'Date' format 999999
column origin_time heading 'Time' format 999999.9
column mb heading 'mb' format 9.9
column ms heading 'ms' format 9.9
column yield1 heading 'Yield' format 9999.999
column yield2 heading 'to' format 9999.999
column lats heading 'Lats' format 99.999
column n_s heading ' ' format a1
column longs heading 'Longs' format 999.999
column e_w heading ' ' format a1
column site heading 'Site' format a4
column source heading 'Source' format a5
column comments heading 'Comments' format a20
spool sitedate
select * from nucexp.explosions
      where xdate between '&start_date_eg_480101'
      and '&end_date_eg_481231'
      and site = '&site_code__as_in_the_code_list'
      and pref = '*'
      order by xdate,origin_time;
spool off
exit
```

### File siteall.sql

```
set pagesize 999
set linesize 120
column recno heading '#' format 99999
column group_id heading 'Group' format 99999
column pref heading '' format a1
column xdate heading 'Date' format 999999
column origin_time heading 'Time' format 999999.9
column mb heading 'mb' format 9.9
column ms heading 'ms' format 9.9
column yield1 heading 'Yield' format 9999.999
column yield2 heading 'to' format 9999.999
column lats heading 'Lats' format 99.999
column n_s heading '' format a1
column longs heading 'Longs' format 999.999
column e_w heading '' format a1
column site heading 'Site' format a4
column source heading 'Source' format a5
column comments heading 'Comments' format a20
spool siteall
select * from nucexp.explosions
      where site = '&site_code__see_code_list'
      order by xdate;
spool off
exit
```

### File datepref.sql

```
set pagesize 999
set linesize 120
column recno heading '#' format 99999
column group_id heading 'Group' format 99999
column pref heading '' format a1
column xdate heading 'Date' format 999999
column origin_time heading 'Time' format 999999.9
column mb heading 'mb' format 9.9
column ms heading 'ms' format 9.9
column yield1 heading 'Yield' format 9999.999
column yield2 heading 'to' format 9999.999
column lats heading 'Lats' format 99.999
column n_s heading '' format a1
column longs heading 'Longs' format 999.999
column e_w heading '' format a1
column site heading 'Site' format a4
column source heading 'Source' format a5
column comments heading 'Comments' format a20
spool datepref
select * from nucexp.explosions
      where xdate between '&start_date_eg_800101'
      and '&end_date_eg_891231'
      and pref = '*'
order by xdate,origin_time;
spool off
exit
```

### File dateallgrp.sql

```
set pagesize 999
set linesize 120
column recno heading '#' format 99999
column group_id heading 'Group' format 99999
column pref heading '' format a1
column xdate heading 'Date' format 999999
column origin_time heading 'Time' format 999999.9
column mb heading 'mb' format 9.9
column ms heading 'ms' format 9.9
column yield1 heading 'Yield' format 9999.999
column yield2 heading 'to' format 9999.999
column lats heading 'Lats' format 99.999
column n_s heading '' format a1
column longs heading 'Longs' format 999.999
column e_w heading '' format a1
column site heading 'Site' format a4
column source heading 'Source' format a5
column comments heading 'Comments' format a20
break on group_id skip 1
spool dateallgrp
select * from nucexp.explosions
      where xdate between '&start_date_eg_890101'
      and '&end_date_eg_891231'
      order by group_id;
spool off
exit
```

### File dateall.sql

```
set pagesize 999
set linesize 120
column recno heading '#' format 99999
column group_id heading 'Group' format 99999
column pref heading '' format a1
column xdate heading 'Date' format 999999
column origin_time heading 'Time' format 999999.9
column mb heading 'mb' format 9.9
column ms heading 'ms' format 9.9
column yield1 heading 'Yield' format 9999.999
column yield2 heading 'to' format 9999.999
column lats heading 'Lats' format 99.999
column n_s heading '' format a1
column longs heading 'Longs' format 999.999
column e_w heading '' format a1
column site heading 'Site' format a4
column source heading 'Source' format a5
column comments heading 'Comments' format a20
spool dateall
select * from nucexp.explosions
      where xdate between '&start_date_eg_850101'
      and '&end_date_eg_851231'
      order by xdate,origin_time;
spool off
exit
```

## File prefall.sql

```
set pagesize 999
set linesize 120
column recno heading '#' format 99999
column group_id heading 'Group' format 99999
column pref heading '' format a1
column xdate heading 'Date' format 999999
column origin_time heading 'Time' format 999999.9
column mb heading 'mb' format 9.9
column ms heading 'ms' format 9.9
column yield1 heading 'Yield' format 9999.999
column yield2 heading 'to' format 9999.999
column lats heading 'Lats' format 99.999
column n_s heading '' format a1
column longs heading 'Longs' format 999.999
column e_w heading '' format a1
column site heading 'Site' format a4
column source heading 'Source' format a5
column comments heading 'Comments' format a20
spool prefall
select * from nucexp.explosions
       where pref = '*'
       order by xdate,origin_time;
spool off
exit
```

## File explode.sqr

```
!   This report file called explode.sqr retrieves details on nuclear
!   explosions from the AGSO-ASC Nuclear Explosions Database NUCEXP.

!   The user can input values for      start and end date
!                                       test site codes
!   and also has the option of entering an additional condition for the
!   retrieval.
!   If no values for these attributes are entered by the user the program
!   retrieves the preferred records of ALL nuclear explosions in the database.

!   Written by S. Lenz, Information Systems Branch
!   Date:   17 January 1992      amended:   26 November 1992
```

```
begin-setup
page-size 1000 95
no-formfeed
end-setup
```

```
begin-report
do menu
end-report
```

```
begin-heading 3
print 'NUCEXP - NUCLEAR EXPLOSIONS DATABASE' (1,1)
date-time (1,60)
print 'Date UTC mb Ms Yield ' (+2,1)
print ' Lat Long Site Source Comments' (,+1)
end-heading
```

```
!   start the main procedure and initialise variables
```

```

begin-procedure menu
  move " to $and_xdate_between
  move " to $and_xdate2
  move " to $and_site
  move " to $and_other
  move '99' to $choice

!   display menu and get input for WHERE clause of SELECT statement

while $choice != 'X'
  display "
  display '  Selection menu for extracting information on nuclear'
  display ' explosions from the AGSO-ASC Nuclear Explosions Database'
  display '          NUCEXP'
  display "
  display "
  display "
  display '  1 - start date.....' noline
  display $xdate1
  display "
  display '  2 - end date.....' noline
  display $xdate2
  display "
  display '  3 - test site code.....' noline
  display $site
  display "
  display '  4 - other conditions: ' noline
  display $other
  display "
  display "
  display "
  display '          G - Go      X - Exit'
  display "
  display "
  input $choice ' Enter a number to change retrieval conditions or G/X '
  display "
  display "
  uppercase $choice
  evaluate $choice
  when = '1'
    input $xdate1 ' Enter the start date e.g. 850101 ' type=number
    if $xdate1 = ""
      move $xdate1 to $and_xdate_between
    else
      string 'and xdate between' $xdate1 by '' into $and_xdate_between
    end-if
    break
  when = '2'
    input $xdate2 ' Enter the end date e.g. 851231 ' type=number
    if $xdate2 = ""
      move $xdate2 to $and_xdate2
    else
      string ' and' $xdate2 by '' into $and_xdate2
    end-if
    break
  when = '3'
    input $site ' Enter the test site code e.g. "NTS" (in single quotes) '
    if $site = ""
      move $site to $and_site
    else

```

```

    string 'and site = ' $site by '' into $and_site
end-if
break
when = '4'
input $other ' Enter additional condition e.g. mb > 3 '
if $other = ''
    move $other to $and_other
else
    string 'and ' $other by '' into $and_other
end-if
break
when = 'G'
do xdetails
do xparams
break
when-other
display $beep
break
end-evaluate
end-while
end-procedure

```

```

begin-procedure xdetails
begin-select
xdate          (+1,1,6)
origin_time
if &origin_time > 0
    print &origin_time  (,+1,8) edit 999999.9
else
    print ' '          (,+1)
end-if
mb
if &mb > 0
    print &mb          (,+1,3) edit 9.9
else
    print ' '          (,+1)
end-if
ms
if &ms > 0
    print &ms          (,+1,3) edit 9.9
else
    print ' '          (,+1)
end-if
yield1
if &yield1 > 0
    print &yield1      (,+1,8) edit 9999.000
else
    print ' '          (,+1)
end-if
yield2
if &yield2 > 0
    print '-'          ()
    print &yield2      (,8) edit 9999.000
else
    print ' '          (,+1)
end-if
lats
if &lats > 0
    print &lats        (,+1,6) edit 99.999
else

```

```

    print ' '      (,+1)
end-if
n_s
if &n_s > "
    print &n_s      (,1)
else
    print ''      ()
end-if
longs
if &longs > 0
    print &longs   (,+1,7) edit 999.999
else
    print ' '      (,+1)
end-if
e_w
if &e_w > "
    print &e_w     (,1)
else
    print ''      ()
end-if
site      (,+1,4)
source    (,+1,5)
comments  (,+1,20)

```

from nucexp.explosions

```

    where pref = '*'
    [$and_xdate_between]
    [$and_xdate2]
    [$and_site]
    [$and_other]

```

order by xdate

```

end-select
end-procedure

```

```

begin-procedure xparams
begin-document (+1,1)

```

```

.b
.b

```

```

Date:  date of the explosion      Lat:  decimal latitude
UTC:   Universal Coordinated Time Long:  decimal longitude
mb:    body wave magnitude        Site:  test site
Ms:    surface wave magnitude     Source: source document
Yield: yield of the explosion
end-document
end-procedure

```

## APPENDIX D: EXAMPLE OF REPORT OUTPUT

NUCEXP - NUCLEAR EXPLOSIONS DATABASE

06-May-1993 11:26 AM

Date	UTC	mb	Ms	Yield	Lat	Long	Site	Source	Comments
850210	32707.6	5.9	4.6		49.860N	78.840E	EKaz	ISC	
850425	5706.5	5.9	5.0		49.880N	78.960E	EKaz	ISC	
850615	5700.9	6.1	4.7		49.850N	78.870E	EKaz	ISC	
850630	23902.9	6.0	4.6		49.840N	78.690E	EKaz	ISC	
850720	5314.8	6.0	4.6		49.920N	78.800E	EKaz	ISC	
850725	31106.9	5.0	3.7		49.860N	78.060E	EKaz	ISC	

Date: date of the explosion

Lat: decimal latitude

UTC: Universal Coordinated Time

Long: decimal longitude

mb: body wave magnitude

Site: test site

Ms: surface wave magnitude

Source: source document

Yield: yield of the explosion

## APPENDIX E: CONTENTS OF TABLES XSITES AND XSOURCES

Site	Description
Bik	Bikini Island (USA)
CKaz	Central Kazakhstan, USSR
Chl	Christmas Is.(USA)
EKaz	Eastern Kazakhstan, USSR
Ene	Enewitok (USA)
Fang	Fangataufu
Jol	Johnson Is. area (USA)
LopN	Lop Nor, Sinkiang Province, China
MISC	Miscellaneous - specify under 'comment'
Mbl	Monte Bello Is.(UK)
Mur	Mururoa Atoll, Tuamotu Archipelago (Fr)
NTS	Nevada Test Site, USA
NovZ	Novaya Zemlya, USSR
USSR	specify under 'comment'
Ural	Ural Mountains, USSR

### Source Description

APTA	American Peace Test Alerts
ASAR	Alice Springs seismic array
ASPA	Alice Springs seismic station
BOLT	Bolt, B.A., 1976. Nuclear Explosions and Earthquakes. The Parted Veil. W.H.Freeman and Co, San Francisco.
CSS	Center for Seismic Studies, USA
CTAO	Charters Towers seismic station
DAHL	Dahlman, O. & Israelson, H., 1977. Monitoring Underground Nuclear Explosions. Elsevier, Amsterdam.
FOA	Seismology (Yearly Reports), FOA Reports, Sweden
GLAS	Glasstone: The Effects of Nuclear Weapons. 1964
ISC	International Seismological Centre, UK
MISC	Miscellaneous
NAO	Norsar seismic array
NDRI	telex from National Defence Research Institute, Sweden
NRDC	Known US Nuclear Tests: July 1945 - 31 Dec 1987 by Norris, Cochran & Aikin, Natural Resources Defense Council.
NZ	New Zealand
PDE	Preliminary Determination of Epicenters, USCGS/NOA/ERL/GS
PEK	Peking, China
QED	Quick Determination of Epicenters, USGS/NEIC
SFIL	Shane's List
SIXN	Six Nation Initiative, Sweden
SMITH	Smith,Joan: Clouds of Deceit
USAEC	US Atomic Energy Commission
WRA	Warramunga seismic array