MAKING USE OF THE INTERNET TO OBTAIN DATA ON NUCLEAR REACTOR PERFORMANCE AND HEALTH RISK NEAR REACTORS: A GUIDE FOR NON-HEALTH PROFESSIONALS

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Monitoring the performance of nuclear reactors is a function assigned to government regulatory agencies at the national, state, and federal levels. However, it is important that citizens also have the ability to monitor performance. Reactors routinely emit hazardous radioactive chemicals as they operate, threatening the safety of the air, water, and food.

The development of the internet has made an enormous amount of information available to the general public. The following guide outlines some of the more useful sources of information, and gives instructions on how interested persons – who do not have to be health or scientific professionals - can obtain data.

A. REACTOR PERFORMANCE AND RADIATION LEVELS

1. List of U.S. nuclear plants.

The U.S. Nuclear Regulatory Commission is authorized by law to ensure that nuclear reactors operate within specified guidelines. The NRC licenses utility companies to operate reactors, and monitors their performance.

The NRC's web site (www.nrc.gov) contains a very large amount of data on reactors. Perhaps the most basic information (name of reactor, location, which utility operates the reactor) can be obtained by

a. www.nrc.gov
b. (click) nuclear reactors
c. (click) power reactors
d. (click) list of power reactors

2. License extension status

Reactors are licensed by the NRC for a 40 year period. Recently, a number of utilities have requested a 20-year extension of reactor licenses. To find the list of utilities (and reactors) that have either been granted extensions, have applied for extensions, or have indicated interest in applying, do the following:

a. www.nrc.gov
b. (click) reactor license renewal
c. (click) status of current applications and industry initiatives

As of early May (of 103 reactors), 30 had been granted license extensions, 18 had applications under review, and another 23 were the subject of letters of intent to apply for license renewal.

To find a calendar of dates for each reactor's license extension process, click on the name of the reactor in the status list.

3. Licensing New Reactors

While no new nuclear reactor in the U.S. has been ordered since 1978, several utilities have recently expressed interest in new orders. In the fall of 2003, three utilities (Dominion, Entergy, and Exelon) submitted "Early Site Permit" applications to the NRC, which are required before the full application for a new reactor. The three companies are seeking permits for new reactors at the North Anna VA, Grand Gulf MS, and Clinton IL sites).

The NRC web site contains information about new reactor licensing. To view a schedule of the various steps, including public meetings and public comment periods, for each Early Site Permit application, go to

a. www.nrc.gov

b. (click) nuclear reactors
c. (click) power reactors
d. (click) new reactor licensing
e. (click) Early Site Permits – Licensing Reviews
f. (click) review schedule

4. Percent of time reactors operate

One safety and health issue of nuclear reactors is the percent of time that they operate. Before the 1990s, U.S. nuclear reactors often were shut down due to mechanical problems. In recent years, however, utilities have altered operations to improve efficiency. Since 2000, U.S. reactors have operated about 91% of the time, which is a health and safety concern since reactors are aging. Running old reactors a greater percentage of the time may mean higher emissions into the environment.

To calculate the percent of time that a reactor operates, follow these steps

a. www.nrc.gov
b. (click) Electronic Reading Room
c. (click) ADAMS documents
d. (click) Web-based access
e. (click) Begin ADAMS search
f. (click) Advanced search
g. In first (search) box, enter name of plant (such as Dresden)
In third (title) box, enter Monthly Operating Report
h. (click) Search

The user will now see a series of documents; each is a monthly operating report that the utility submitted to the NRC. As of early May 2005, all reports from November 1999 to March 2005 are available.

To find out how many hours the reactor operated in a year, click on to the December monthly report for that year. Scroll down until the words "Hours critical" or "Reactor critical" are found. Three numbers will appear

the hours critical for the month
the hours critical for the year
the hours critical for the lifetime of the reactor.

	Month	Year	Lifetime
It may look something like	744.0	8310.0	154,663.7

To calculate the operating factor for 2004, take the number of hours critical and divide it by the number of hours in the year. In 2004, there were 366 days, so 366 times 24 hours = 8784 hours.

8310 / 8784 = 94.6%

5. Emissions from nuclear reactors.

Nuclear reactors emit generally low doses of radioactivity into the air and water, not just from accidents but during routine operations. It is important to understand emission patterns and trends in evaluating safety and health risks.

Each utility is mandated to report annual emissions to the NRC, which may be obtained by:

a. www.nrc.gov
b. (click) Electronic Reading Room
c. (click) ADAMS documents
d. (click) Web-based access
e. (click) Begin ADAMS search
f. (click) Advanced search
g. In first (search) box, enter name of plant (such as Dresden)
In third (title) box, enter Annual Operating Report
g. (click) Search

Each Annual Radiological Environmental Operating Report from 1999 to 2004 for each plant is available as of early May 2005. However, it appears that no numerical data exists. Instead, utilities simply report that emission were monitored and fell below the federally-prescribed limits.

6. Environmental radiation levels

Each state's department of environmental radiation measures levels of man-made radioactivity in the air, water, soil, etc. Most states do not post the results on the internet. However, the U.S. Environmental Protection Agency also performs monitoring, and results are kept on the portion of the EPA web site dedicated to the National Air and Radiation Environmental Laboratory.

To access data on EPA's environmental radioactivity levels, a user should do the following:

a. www.epa.gov/narel
b. (click) Environmental Radiation Data
c. (click) Environmental Radiation Data Report

The web site has a series of quarterly reports, from #75 (July to September 1993) to #115 (July to September 2003). Clicking on the desired report will reveal the contents; each is about 30 pages long.

If a user selected report #114 (April to June 2003), and wanted measurements for locations in Iowa, they would find the following:

- Tables 2-4 are monthly tables of Gross Beta in Airborne Particles. Of the 40 to 50 sites, Iowa City IA is one. The right hand column in the tables gives the average picocuries of beta per cubic meter of air. In Iowa City, the levels were .014 in April; .009 in May; and .011 in June.

- Tables 5-7 are monthly tables of Gross Beta in Precipitation, covering 30 to 35 sites including Iowa City. The left hand column in the tables gives the average picocuries of beta per liter of water. In Iowa City, the levels were 0.90 in April; 1.99 in May; and 1.14 in June.

- Table 8 includes three monthly tables of Tritium in Precipitation, covering 40 to 50 sites. The Iowa City levels, measured in picocuries of tritium per liter of water, are 21, -18, and 13. (Because of measuring error, some samples are less than zero).

- Tables at the end of the report cover monthly milk samples of Cesium-137, Iodine-131, and Barium-140. Since December 1990, instead of supplying actual numbers, EPA simply gives a "ND" (not detectable below a certain level) for each of the 60 cities in the program, so there are no milk data that can be analyzed.

7. In-body radiation levels

In 1970 and 1971, the U.S. government defunded two programs that measured radioactive Strontium-90 in American children, one in bone and one in teeth. With no program to measure in-body levels of radioactivity near nuclear reactors, the Radiation and Public Health Project began a study of Sr-90 in baby teeth. The group has collected and tested over 4000 teeth, and has posted results on its web site.

To find results, go to

a. www.radiation.org
b. (click) Want to know the results of the tooth study where you live?

The user will view a table of average Sr-90 concentrations in baby teeth in five states (with at least 130 teeth) and in counties near six nuclear plants (with at least 50 teeth). The report will be expanded as more teeth are received and tested.

B. DATA ON HEALTH EFFECTS OF REACTORS

1. Death rates

For decades, U.S. public health departments have collected and published extensive data on death patterns. The U.S. Centers for Disease Control and Prevention web site now maintains data on all deaths to U.S. residents from 1979-2002, and adds the most recent year each spring. Data are available by cause of death, race, sex, age, state, and county, and can be accessed by:

a. http://wonder.cdc.gov
b. (click) underlying cause of death
c. mortality for 1999-2002 with ICD-10 codes
   or
   mortality for 1979-1998 with ICD-9 codes

The user then will view a screen in which a number of variables can be selected. The variables are almost all self-explanatory. An illustration of how to request and access data follows.

Goal: To find out the 2002 infant mortality rate for blacks in Cook County IL. Several variables need to be selected, beginning at the top of the screen, while others are set at default values and don't need to be changed. The ones to be changed are:

Select state – Illinois
Select county – Cook
Select race – Black
Select age ranges – Under 1 day to 28-364 days
Select years – 2002 to 2002
Summarize data by – County

(click) send

The output appears as follows

Location code	County	Death Count	Population	Crude Death Rate
17031	Cook	359	23,057	1557.0

This means that in 2002, there were 23,057 births to blacks mothers residing in Cook County, and 359 deaths to babies under age one year to black mothers. Dividing 359 over 23,057 and multiplying by 100,000 gives a rate of 1557.0 deaths per 100,000 persons (births).

Clicking on the red "X" in the top right hand corner of the screen returns the user to the main screen. To obtain the 2002 national infant death rate for blacks, one only needs to change two variables:

Select state – United States
Summarize data by – Race

Race	Death Count	Population	Crude Death Rate
Black	8,524	593,691	1435.8

Thus, the user now knows that the Cook County infant death rate (1557.0) is higher than the national rate (1435.8). It is 8.4% higher

(1557.0 - 1435.8) / 1435.8 = .084 times 100 = 8.4%

Goal: To examine recent trends in cancer death rates for children under age 15 in Cook County, IL. Again, several variables need to be selected from the CDC mortality menu.

Select state – Illinois
Select county – Cook
Select age ranges – Under 1 day to 10-14 years
Select years – 1999 to 2002
ICD code ranges – c00 (upper left hand box); d48.9 (upper right hand box)*
Summarize data by – Year

* see appendix for code ranges of selected causes of death

(click) send

The output appears as follows

Year	Death Count	Population	Crude Death Rate
1999	27	1,180,356	2.3
2000	42	1,182,863	3.6
2001	30	1,174,876	2.6
2002	33	1,170,054	2.8

The user can see that the rate rose in 2000, declined in 2001, and rose again in 2002. If data prior to 1999 are desired, one can click on the "previous window" key (upper left hand corner), and choose the option "mortality for 1979-1998 with ICD-9 codes."

2. Birth-related rates

The CDC web site also provides information on births from 1995 to 2002, only for counties with populations over 100,000. Of all the variables on the site, perhaps the most important two for radiation-related research are gestation period and birth weight. Exposure to harmful radiation may raise the risk of a baby being born prematurely or at low weight.

Goal: To find out the percent of white babies in Cook County who were born at low weight in 2002 (the standard definition of underweight is below 2500 grams, or 5.5 plans).

a. http://wonder.cdc.gov
b. (click) natality

Only several of the variables need to be changed; default settings can be left on the others. The first step is to request the number of underweight births.

Select state – Illinois
Select county – Cook
Year(s) – 2002 to 2002
Birth weight – 499 gms or less through 2000-2499 gms
Mother's race – White
Display data by – Year

(click) Send

The output appears as follows

Year	Births
2002	3,633

The second step is to request the total number of births (only use births with a stated weight)

(click) the red "X" on the top right hand part of the screen
Change only Birth weight – 400 gms or less through 5000-8165 gms

The output appears as follows

Year	Births
2002	53,790

The percent of births that are underweight is 6.75% (3,633 / 53,790) x 100 = 6.75

Goal: To review the 1995-2002 trend in premature births among black babies in Cook County. (For purposes of this analysis, we will define prematurity as any live birth with a gestation period under 37 weeks).

Click on the red "X" on the top right of the screen, and change only the following variables. The first step is to request the number of premature births.

Years – 1995 to 2002 (also the default setting)
Birthweight – 499 grams or less through Not Stated (also the default setting)
Mother's Race – Black
Gestation Period – Under 20 weeks through 36 weeks
Display Data By – Year

Send

The output appears as follows:

Year	Births
1995	5,688
1996	5,254
1997	5,032
1998	5,066
1999	4,948
2000	4,635
2001	4,551
2002	4,249

The next step is to request the total number of births with a stated gestation period. Click the red "X" and change the gestation period to Under 20 weeks to >= 42 weeks. The output appears as follows:

Year	Births
1995	28,995
1996	27,783
1997	27,046
1998	27,104
1999	25,550
2000	25,363
2001	24,399
2002	22,984

The percent born premature can be calculated for each year:

1995 (5,688 / 28,995) x 100 = 19.6% (use the same formula for each year)

3. Disease incidence – National cancer statistics

While U.S. public health departments maintain an extensive, centralized system of disease mortality (deaths), the situation is different for disease incidence (cases). For many diseases, the only statistical information available is an estimate of the number of cases nationally or regionally.

Each state now operates a cancer registry, also known as a tumor registry. But many states only began these registries since the late 1980s. Thus, no centralized data base of all 50 states exists.

The closest to a "national" cancer incidence database in existence is known as SEER (Surveillance, Epidemiology, and End Results), operated by the National Cancer Institute. SEER, formed in 1973 as part of President Richard Nixon's War on Cancer, includes information from cancer registries in five states (Connecticut, Hawaii, Iowa, New Mexico, and Utah) and four metropolitan areas (Atlanta, Detroit, San Francisco, Seattle). Each of these areas had a comprehensive cancer registry by the early 1970s. About 10% of the total U.S. population lives in these areas.

SEER includes cancer incidence and mortality; but since the CDC web site is so comprehensive for mortality, SEER should only be used for incidence.

The user can access the SEER data base as follows:

a. www.seer.cancer.gov
b. (click) SEER Cancer Statistics Review, 1975 - 2002

(The 2002 volume is the most current SEER data. Additional years are added each spring. But each volume beginning in 1993 is also on the site; if these are needed, click "Previous Versions of the CSR" and select the desired year).

c. Contents of the CSR

The user will now view a long list of options. Many correspond to certain types of cancer; thyroid cancer, leukemia, and childhood cancer are often of great interest to radiation researchers. Click on the desired cancer type, and a series of reports on incidence and mortality trends and patterns will appear.

The best use of SEER is to provide national cancer incidence rates to be compared with incidence near nuclear plants.

4. Disease incidence – State and county cancer statistics

A number of state cancer registries now make statistical data available on the internet. They tend to be listed under the Department of Health in a state government's web site. Illinois maintains one of the most comprehensive online data sets from a cancer registry, containing detailed data by type of cancer by county. (Pennsylvania is another good one; it contains county-specific and municipality-specific information).

County-specific data from the Illinois site from 1986 to 2000 can be accessed.

a. http://app.idph.state.il.us
b. (click) IPlan data system
c. (click) County-level report

The user will now be asked to select certain variables. An example of trends in childhood cancer incidence rates in Will County (near the Dresden plant) follows:

Select county(s) – Will
Select indicator – 4.14.10 Childhood Cancer Age-Adjusted Incidence Rate
Select a Data Year – All Years

Search

The output appears as follows:

	Year: 96-00				
Ages 0-14	Will		Illinois		
	Rate	Number	Rate	Number	U.S.
	138.9	83	140.8	1902	146.4

Each five year group will follow (95-99, 94-98, etc., with the final one appearing as)

	Year: 86-90				
Ages 0-14	Will		Illinois		
	Rate	Number	Rate	Number	U.S.
	140.6	62	134.0	1692	142.2

From the above data, we can observe that the Illinois rate rose from the late 1980s to the late 1990s (134.0 to 140.8) while the Will County rate declined slightly (140.6 to 138.9). In the late 1990s, the Will County rate (138.9) falls below the state rate (140.8) and the U.S. rate (146.4).

5. Medical journal articles

Another way to obtain information on the health of populations living near nuclear plants is to consult articles that have been published in medical journals. The National Library of Medicine has made citations of all articles (and abstracts of most articles) published since 1966 available on the internet.

The site is www.nlm.nih.gov; and by clicking the "Pub Med" option, the user can select any combination of words, representing topics or authors, to obtain a list of articles. An example of one request would be to enter "childhood leukemia AND nuclear plants."

The article abstracts tend to be written in technical language, and does not present all data, so this site is limited. However, it can be helpful in obtaining professional backup for any research efforts.

C. ISSUES THAT CAN BE ADDRESSED USING INTERNET DATA BASES

1. Do local infant death rates increase after reactors start?

2. Do local infant death rates decrease after reactors close?

3. Are local childhood cancer death rates higher than state/national rates?

4. Do cancer death rates rise as a plant ages? (as plant is running almost all the time)

5. Are environmental radioactivity levels rising over time?

6. How much of the time is a plant in operation?

APPENDIX

Commonly-Used Disease Codes To Be Used With CDC Web Site For Computing Death Rates

Cause of Death	ICD-9 (1979-1998)	ICD-10 (1999-2002)
All Causes	000.1 - 999.9	A00 – Z99.9
All Medical Causes*	000.1 – 799.9	A00 – R99.9
All Cancers	140.0 – 239.9	C00 – D48.9
All Malignant Cancers	140.0 – 208.9	C00 – C97.9
Bone Cancer	170.0 – 170.9	C40 – C41.9
Breast Cancer (Female)	174.0 – 174.9	C50 – C50.9
Cervical Cancer (Female)	180.0 – 180.9	C53 – C53.9
Hodgkin's Disease	201.0 – 201.9	C81 – C81.9
Leukemia	204.0 – 208.9	C90.1 – C95.9
Multiple Myeloma	203.0 – 203.9	C90 – C90.0
Non-Hodgkin's Lymphoma	200.0 – 200.9 202.0 – 202.9	C82 – C85.9
Ovarian Cancer (Female)	183.0 – 183.9	C56 – C56.9
Thyroid Cancer	193	C73 – C73.9
Uterine Cancer (Female)	182.0 – 182.9	C54 – C54.9
Birth Defects	740.0 – 759.9	Q00 – Q99.9
Diabetes	250.0 – 250.9	E10 – E14.9
HIV/AIDS	042.0 – 044.9	B20 – B24.9
Septicemia	038.0 – 038.9	A40 – A41.9
Viral Hepatitis	070	B15.0 – B19.9
Respiratory Diseases	460 – 519.9	J00 – J99.9
Circulatory Diseases	390 – 459.9	I00 – I99.9

* All causes excluding accidents, suicide, and homicide