Former Worker Medical Surveillance Program at Idaho National Engineering and Environmental Laboratory (INEEL)
Phase I: Needs Assessment

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EXECUTIVE SUMMARY

Purpose We report the results and analysis of a one year needs assessment study evaluating whether a medical monitoring and risk communication program is justified for former workers at the Idaho National Engineering and Environmental Laboratory (INEEL).

Methods To complete this study, we used available exposure assessment data from paper records and electronic databases and reviewed all studies that had been completed at the plants. We interviewed investigators who have completed or are currently engaged in studies at INEEL. We also gathered "expert" former and current workers to conduct risk mapping sessions and focus groups to obtain in-depth information about the plants. We collected and analyzed responses to a questionnaire that was sent to a stratified random sample of 1,000 former INEEL workers. We obtained employee rosters and basic employment data, to the extent available, from the contractors and other institutions.

Findings Former INEEL workers have had significant exposure to pulmonary toxins (nickel, asbestos, beryllium, and acids), carcinogens (external and internal radiation, asbestos, beryllium, and cadmium), renal toxins (chlorinated solvents and lead), neurotoxins (mercury, solvents and lead), hepatotoxins (carbon tetrachloride and other solvents) and noise. Epidemiologic studies at INEL are lacking. Workers are concerned about previous exposures and are interested in a medical screening and education program. Former workers have good access to health care and engage in periodic health examinations. However, most do not believe that their primary care providers know much about the exposures that they had at INEEL. The focus groups and questionnaire responses also provided useful guidance about how to establish effective risk communication and medical surveillance programs.

The target population for a medical screening program among former INEEL workers is estimated to range from 2,300 to 17,500. This range requires refinement, but the roster with names and addresses that would allow initiation of screening at the lower end of this range is currently available.

Conclusion The findings of this needs assessment study support a targeted medical surveillance program. This conclusion is based on 1) the evidence that large numbers of workers have had significant exposures to detrimental agents, and 2) the need and desire expressed by former workers for a credible targeted program of medical surveillance and education. A health protection and risk communication program should center on workers at risk for 1) cancer, 2) chronic respiratory disease, including chronic obstructive lung disease and the pneumoconioses, 3) kidney and liver disease, and 4) hearing loss. These conditions are amenable to early intervention, amelioration, and/or primary prevention. A risk communication delivered by a credible source will reduce uncertainty and distrust. After participation in the proposed screening program, former DOE workers will have increased real knowledge about their personal health status, what is known about their risks, and how they can promote their own health. We believe that mounting such a program in Phase II will make a tangible contribution to the health of former INEEL workers.

PART I: OVERVIEW

I. INTRODUCTION

In October, 1997, a consortium led by the Oil Chemical Atomic Workers (OCAW) International Union initiated a needs assessment study to evaluate whether former Department of Energy (DOE) workers at the Idaho National Engineering and Environmental Laboratory (INEEL) would benefit from the establishment of a program of medical surveillance. This assessment was conducted under a contract from and with the guidance of the Department of Energy. The OCAW consortium was constituted by Queens College of the City University of New York, the University of Massachusetts Lowell (UMass Lowell), and the OCAW International Union. The needs assessment at the INEEL facility benefited from the experience that the consortium gained in 1996-1997 when we conducted a similar needs assessment at the three gaseous diffusion plants owned by the Department of Energy (Oak Ridge Gaseous Diffusion Plant (K-25), Portsmouth Gaseous Diffusion Plant, and Paducah Gaseous Diffusion Plant).

To conduct this needs assessment, the OCAW/Queens College/UMass Lowell consortium identified the need for four domains of information. These include:

- Exposure characterization for the workforce at INEEL
- Epidemiologic and other health studies, to the extent available
- Educational needs and organizational context for delivery of medical surveillance and risk communication programs
- Demographic profile of target population

These domains correspond to the criteria established by the DOE in its document, *Guidance for Phase I Reports and Phase II Applications.*

Through a vigorous and focused 12 month effort organized in these domains, we have addressed the specific issues raised by the Department of Energy in determining whether a medical surveillance program is needed and would benefit the targeted populations. These specific issues include characterizing the type and degree of relevant detrimental exposures; defining essential health impacts; defining the size of the target populations, and finally, documenting the need for establishing a program that will combine medical monitoring with risk communication.

To provide answers to these questions in one year was an ambitious task. Unlike several of the other grantees in this program, the OCAW consortium had not been funded previously to conduct a systematic investigation at INEEL facility. Further, unlike some of the other DOE facilities, INEEL has been little studied, so we were unable to utilize much previous work, such as exposure characterization and roster identification. NIOSH is presently conducting INEEL's first systematic health study ever, a cohort mortality study. While its results will be very useful to our project when available, the study is still in progress. Hence, available data from INEEL are quite limited.

On the other hand, we had the great advantage of having excellent access to and high credibility with many members of the workforce that operated INEEL and excellent cooperation of two of the main contractors who operate the site, Lockheed-Martin (LMTCO) and Argonne-West.. Our challenge during the past 12 months has been to harness the enormous knowledge possessed by the DOE workforce in combination with mining available health physics data and limited industrial hygiene records. To the extent possible, we rely upon the knowledge that has been accumulated by NIOSH and the CDC in their studies. As further information from those studies becomes available, we will use this additional information for planning and conducting a medical surveillance program. In particular, if DOE supports Phase II of the program, the NIOSH cohort mortality study will be useful in refining the population at risk and in specifying types and levels of risks that the target population has experienced.

Throughout the needs assessment process, the OCAW consortium has abided by a central principle of the project: to maximize involvement of rank and file workers from INEEL in all aspects of the conduct of the needs assessment process and the planning of the medical surveillance and risk communication program. We have used this method for several essential reasons. The most obvious is the that rank and file workers are excellent sources of information for identifying the hazards that have existed at INEEL over the past 40 to 50 years. This is especially true since there is a dearth of industrial hygiene data and an absence of epidemiological studies at the site. Second, the study consortium understands that any program planning process will be effective only to the extent to which the so-called recipients of the program are involved. Finally, health protection, the ultimate goal of the DOE Former Worker Medical Surveillance Program, requires workers acting on their own behalf. Beginning to overcome the many years of distrust, uncertainty and ignorance that some workers at DOE facilities have requires an open and participatory process from the very beginning of a medical surveillance program.

This report does not contain an exhaustive list of all of the medical needs that workers at INEEL might have as a result of their occupational exposures. Creating such an exhaustive inventory of all health risks that INEEL workers have or might have was beyond the scope, the mandate and the resources available to the OCAW consortium in the past 12 months. We recognize that the DOE former worker medical surveillance program is pilot in nature and will be limited in funds over the next several years.

Hence, we concentrated on exposures and possible health outcomes that best meet the criteria that DOE has established for this program as reflected in Section 3162 that created the program. Specifically, we have attempted to identify significant exposures, as supported by available qualitative and quantitative data, that have or are likely to produce health impacts that might be alleviated by early detection and/or by communication with the potentially affected workers. There are undoubtedly other exposure-disease relationships expressed in INEEL workers that deserve the attention of the Department of Energy. This would include possible health impacts that have not yet been fully investigated in the workforce; exposures for which data are insufficient to allow judgment about the likelihood of their significance; health impacts that had been demonstrated to exist but may or may not be occupational in etiology; and health outcomes that are not amenable to screening or for which early detection does not lead to fruitful intervention. Pursuing these possibilities, however important, was not part of the mandate that we received from the Department of Energy. Nor could we take responsibility for following up these potential or actual occupational risks, given the limited time and resources available to us during this 12 month needs assessment.

This report is organized into two parts to satisfy the competing goals of being succinct and of being substantive. Part I (Introduction, Methods, and Principal Findings) is intended as an overview in order to communicate the principal methods used and the results thereby obtained. This overview distills the more detailed collections and summaries of data which are presented in Part II (Sections 5 through 8). Section 5 provides details about the type and levels of exposures experienced by former workers at INEEL as identified in available industrial hygiene and health physics data and through risk-mapping sessions. Section 6 presents the results of focus groups of former and current INEEL workers in assessing health concerns, evaluating the level of knowledge and perceived risks, and eliciting opinions about how to conduct a medical surveillance program. Section 7 provides the results of a questionnaire sent to 1,000 former INEEL workers to collect information on exposures and current health care. Section 8 summarizes information obtained through construction of community inventories of health care and educational resources. Readers are encouraged to read Part II in detail to gain a full understanding of study methodology and the types of information that underlie the summaries presented in Part I.

II. METHODOLOGY

We employed a number of methods of study during this 12 month needs assessment. These methods were chosen based on the ability to obtain reliable data within a limited time period, the desire to include rank and file workers in the data gathering process, and the need to acquire information that would allow us to plan the risk communication and health service component of a medical surveillance program.

A. Review of Existing Exposure Records

The primary focus of this component of the exposure assessment was to determine, to the extent possible, the nature and intensity of major exposures as a function of building, area, department, and/or job classification. Another primary need was to determine whether we could establish an approach for linking the building, department and exposure data to individuals within the former worker cohort.

The primary documents and data files which were used for this preliminary exposure assessment are listed below. A full listing of the major sources of health physics and industrial hygiene data that we used from the gaseous diffusion sites is provided in Section 5.

Principal Sources of Data for Exposure Assessment

The primary documents / data files which were identified during this preliminary assessment included:

1) "Master Update Dump" or MUD Database (1944 – 1985 External and Internal Radiation Exposure Records)
2) Radiation Dosimetry System (RDS) (1986 – current External and Internal Radiation Exposure Records)
3) Security Information Management System (SECIMS) Database (personnel and work history information)
4) Roster Database (Revision of SECIMS being developed by NIOSH)
5) Naval Reactor Facility (NRF) Dosimetry Database (1949- 1991 External and Internal Exposure Records for NRF Westinghouse employees)
6) Naval Reactor Facility (NRF) Work History Database (personnel and work history information for Westinghouse employees)
7) Off-Site Dose Reconstruction, Chemical Dose Reconstruction Draft Report, CDC
8) Off-Site Dose Reconstruction, Preliminary Assessment, SCA, Inc.
9) CDC Dose Reconstruction Database (INELCHEM Database)
10) NIOSH, Preliminary Protocol for an Epidemiological Study of Workers at the INEEL
11) Occupational Radiation Exposure History of the Idaho Field Office Operations at the INEL, J. Horan
12) Annual Health and Safety Division Reports, 1958 – 1971, USAEC Idaho Operations Office
13) ICPP Industrial Hygiene Database (HP-3000 Database, primarily records post 1985)
14) CFA System 80 Industrial Records database (1989 – current records for TAN, TRA and CFA)
15) ICPP Annual and Quarterly Production Reports, (1955 – 1971)
16) CPP Operator Process Make-Up Handbook (contained process chemistry for CPP-601 operations)
17) CDC Interview Transcripts (Personnel and Retiree interview transcripts from CDC Database)
18) Dosimetry Program Reports (IDO-12007, IDO-12070, ACI-167)
19) Work History Database (Dr. Dale Minter, MD) –(location still undetermined).

B. Risk mapping

Risk Mapping is an approach that has been used extensively at industrial facilities as a tool to assist workers and/or joint health and safety committees in determining high risk areas within their facilities. Traditionally, the technique is used to identify current problem areas with a facility and to assist in developing an intervention strategy for resolving the problem areas. For this project, the risk mapping approach was used to map past exposure conditions at INEEL.

In addition to using the mapping process for locating past exposure conditions within the buildings of interest, the method was modified to allow the field researchers to collect semi-quantitative exposure data for each identified exposure of concern. Field researchers also collected data regarding other building and process characteristics (i.e., description of major processes, number of workers in the building of interest, and years of operation).

Several steps were necessary to develop the risk mapping activity at INEEL. We customized the risk mapping method for use in retrospective exposure assessment. We used the following tools, which we had previously developed at the DOE gaseous diffusion plants, for field use:

- *Job Exposure Information Sheet* to collect job/process/exposure information for each chemical agent identified on the risk map.

- *Building Characteristics Report Form* to allow field researchers to collect descriptive information on the buildings of interest over time (i.e., description of major process, number of workers, and years of operation).

- *Risk Mapping Training Guidebook* to train the field researchers in the risk-mapping technique.

The study consortium, led by UMass Lowell, conducted a two day train the trainer session for the field researchers. The field researchers included OCAW local union worker trainers, local union health and safety representatives, and retirees.

"Experts" were then selected for the initial risk mapping session at each of the three sites. The UMass Lowell, the OCAW International, and OCAW Local Union worked at INEEL together to identify and to assemble an "expert" team of former workers for the initial risk mapping sessions. The "experts" selected for the initial sessions consisted primarily of hourly workers with extensive experience at the site. Several line supervisors were also included in these sessions. "Experts" were not selected at random, but based on their vast amount of site experience and the broad array of job classifications and process buildings where they worked.

The initial risk mapping session focused on the entire INEEL complex and was conducted to assist in determining priority areas for future, more specific, risk mapping sessions. As a product of this session, the expert group produced a list of five primary facilities of highest concern regarding retrospective exposures: CPP, TAN, TRA, CFA and ANL. This list, along with information obtained through review of other monitoring data, was used to identify areas for subsequent risk mapping sessions.

The second round of risk-mapping sessions were specifically conducted to learn more about the priority buildings at each of the facilities that were identified in the initial session. Information was systematically collected utilizing the tools list above: the Job Exposure Information Sheet and the Building Characteristics Report Form.

All of the information obtained for risk-mapping sessions was compiled into a database to allow for assessment of the data.

To date, a total of 20 risk mapping sessions have been conducted. These risk-mapping activities have included approximately 60-70 retirees. In each session, an attempt was made to obtain the participation of representatives from a variety of job titles who worked in the building in question. We succeeded in that we were able to include representatives from supervision, scientists/engineers, HPs, operators, and maintenance crafts.

The findings of the risk mapping sessions are summarized within Section III of Part I of this report and the database report of the data collected from the individual sessions is included in Section V. A breakdown of exposures by building is included within an appendix of Section V.

C. Focus groups

Focus groups of former workers were conducted in order to obtain in-depth information about a variety of issues, including exposures, perceptions of risk, health concerns, health care, and receptivity to a health screening program. The overall design, recruitment strategy, training, and analysis was led by Sylvia Kieding of OCAW International Union and consultant Susan O'Brien, who directs training for the New York Committee for Occupational Safety and Health (NYCOSH). The actual implementation of the focus groups was led by former or current workers from INEEL.

Established OCAW Occupational Safety and Health Education Coordinators (OSHECs) at INEEL were recruited to serve as moderators for the focus group sessions. They were trained using a Moderator Guide specifically developed for this project (available upon request). To prepare, moderators participated in a day long training seminar and role-play. Another OCAW member was recruited and trained to serve as the scribe for each focus group session.

Two focus Groups were held at INEEL on June 22, 1998. A total of 23 people participated in the two focus groups. The sessions were held in the OCAW union hall at INEEL. All participants received a participant information sheet and signed informed consent forms that had been read aloud to the group before the session. The sessions were audio taped with the full knowledge and consent of participants.

The initial focus group at each site was comprised of "experts" selected by the local union officers and OCAW field staff due to their knowledge of the plant and familiarity with plant operations. A second focus group at each site included retired and terminated workers who were randomly selected from employee rosters obtained in the course of the needs assessment.

In a preliminary analysis of the transcripts of focus group sessions, an initial coding scheme of important themes was developed. Ms. O'Brien has undertaken a basic coding and sorting of themes and have provided illustrative quotes from the transcriptions. These are presented in detail in Part VI of this report.

D. Questionnaire Survey

In order to obtain exposure and limited health information from a broad cross-section of the former workforce at INEEL, a questionnaire was developed and sent to a random sample of 1,000 retired and terminated INEEL workers. The base population from which this sample was drawn included a total of 5,154 workers, consisting of 2,140 retirees who currently receive pension from Lockheed-Martin; 2,709 workers terminated by Lockheed-Martin since 1964 (when Lockheed-Martin became the site contractor); and 305 retirees who currently receive pension from Argonne West.

In order to ensure adequate representation from the retirees who had left INEEL in the 1960s and 1970s, we stratified the list of Lockheed-Martin retirees by decade of retirement. We selected all of the retirees on the Lockheed-Martin retiree list from the 1960s and the 1970s (n = 120) and 480 of the 2,020 Lockheed-Martin retirees from the 1980s and the 1990s. This represented a 23.7% random sample of the retirees from the 1980s and the 1990s. In addition, we selected randomly 300 (11%) of the 2709 workers who had been terminated from INEEL from 1994 to the present. Finally, we randomly selected 100 (33%) of the 305 Argonne retirees. Hence, we weighted the sample in favor of retirees (versus terminated workers), especially the earlier INEEL retirees and the Argonne West retirees. This weighting was done in order to ensure that we had maximum information from the group that was likely to have had the most employment during early calendar years of INEEL operation and also probably the highest duration of employment and. This corresponds to the group that is *a priori* most likely at risk for occupational disease due to employment at INEEL.

A seven-page questionnaire was developed (Section VII, Appendix A) that requested information on demographic status; history of job title, exposures, and job locations at INEEL; health concerns; current health care; and interest in screening and education. A check list of 35 specific exposures were included in the questionnaire. The questionnaire was approved by the Institutional Review Boards of LMTCO and Queens College of the City University of New York. A copy of the questionnaire was sent to the selected 1,000 individuals with a cover letter signed by Robert Wages (OCAW International President); the local OCAW union president at INEEL; and Steven Markowitz, MD. A second mailing of the same questionnaire with a slightly revised cover letter was sent to non-respondents approximately 6 weeks after the first mailing. Addressed stamped return envelopes were included in each mailing. The questionnaires were sent by first class U.S. mail in order that the letters with incorrect addresses would be returned to the project office.

We report here the preliminary findings from the returned completed questionnaires. We have recently received approval from the Institutional Review Boards of LMTCO at INEEL and Queens College to place telephone calls to former workers who have not responded to either of the mailings of the questionnaire. This will be done later in October in order to improve the response rate and to provide further information about correctness of the current address list that we have for former INEEL workers.

E. Community Inventories

As part of the needs assessment process, we have embarked on developing community profiles, identifying health care, educational, and community service facilities that will be useful in conducting Phase II of the program. This information has been collected by a former INEEL worker who was trained to construct systematic inventories of institutional resources in the communities that related to INEEL. Three specific instruments were developed with the assistance of former and current workers: *1) Health Care Facility Inventory 2) Health Care Provider Inventory*, and 3*) Community Services/Resources Inventory* (available upon request).

These inventories contain essential information to develop strategies for referral of screened individuals for diagnosis and treatment, for provision of workers' compensation assistance, and for designing an effective educational and risk communication program. They also contain useful information for assembling program advisory groups in Phase II of the program. A summary of the inventories is provides in Section VIII of this report. Additional information will be collected according to the specific needs of the implementation phase of the medical surveillance program.

F. Review of Epidemiologic Studies

To our knowledge, there has been no epidemiologic study of the morbidity or mortality experience of INEEL workers. The NIOSH study described previously is the first systematic attempt to collect and analyze such data at INEEL. We obtained the results of a survey of the prevalence of non-malignant asbestos-related disease among maintenance workers at INEEL that was undertaken in conjunction with a law firm from Texas.

G. Demographic Profile of Target Population

Employee rosters have been obtained from Lockheed-Martin and from Argonne West, the two principal contractors whose former workers we are evaluating for the need for medical screening. We have a list of the names and addresses of retirees currently receiving pensions from either of these two employers. We also have a list of names and address of workers who have been terminated by Lockheed-Martin since 1994.

Available data on retirees from Lockheed Martin include name, current address, and date of retirement. For terminated workers from Lockheed Martin, we have name, address (as of the fate of termination), home telephone number, and date of termination. For Argonne West retirees, we have obtained the name, current address, and home telephone number.

The vital status of the workforce at INEEL is currently under investigation by Utterback and colleagues at NIOSH., who are conducting a cohort mortality study at INEEL for NIOSH. Dr. Utterback, has constructed a roster of employees who ever worked at the INEEL site and has preliminary estimates of the numbers of these workers who have died. He has identified and assembled all available databases into a master database. He emphasizes that the following estimates are crude and are useful for consideration of relative magnitude of the sizes of the groups within the cohort.

III. PRINCIPAL FINDINGS

A. Hazards and Exposure Levels of Former INEEL Workers: Results of Records Review and Risk-Mapping

For the purposes of planning a medical surveillance program, it is most useful to organize the large numbers of diverse exposures encountered at INEEL facilities by principal human organ or organ systems affected. In cases where a health effect has been identified by job operation (e.g. -welding) rather than by single exposure, then job title or operation becomes the tool used to organize health effects. Employing this means of considering hazardous exposures yields Table I-I.

Our knowledge about the magnitude of the exposures cited above derives from several sources:, external radiation monitoring, industrial hygiene data, risk mapping sessions, focus groups, and questionnaire results. All of these methods have limitations, as detailed in Part II of this report. A brief summary of data for the most important exposures is provided in the section: the reader is urged to see the additional description in Part II.

Table I-I
Important Classes of Exposures at INEEL by Target Organ

Target Organ/Disease	Exposure Class	Important Examples	Selected Locations
Lung			
Chronic obstructive lung disease	Irritants	Hydrofluoric acid	ICPP
		Hydrochloric acid	ICPP
		Sulfuric acid	ICPP
		Nitric acid	TAN, ICPP
		Cadmium	ICPP
		Welding fumes	TAN, TRA, ICPP
Pneumoconioses	Fibrogenic dusts	Asbestos	CFA, Maintenance
		Beryllium	TAN,TRA,
Lung cancer	Carcinogens	Asbestos	CFA, Maintenance
		Chromium	ICPP, CFA, TAN
		Welding	TAN, TRA, ICPP
Genitourinary system			
Renal toxicity	Renal toxins	Lead	CFA, ETR, TAN
		Chlorinated solvents	TAN, TRA
Endocrine			
Thyroid cancer	Ionizing radiation	Ionizing radiation	ICPP
Hematopoietic system			
Leukemia	Benzene	Benzene	ICPP, TAN
Nervous System	CNS toxins	Mercury	ICPP, TAN
Cognitive dysfunction		Lead	CFA, ETR, TAN
		Chlorinated solvents e.g.-trichloroethylene	TAN, TRA
Gastrointestinal system	Hepatoxicity	Chlorinated Solvents	TAN, TRA
Hepatitis		e.g.-carbon tetrachloride	
Hearing	Noise	Noise	CFA, TRA, TAN
Cardiovascular system	Hypertension	Lead	CFA, ETR, TAN

A.1 External and Internal Radiation

The primary source of personnel external and internal exposure data is the MUD database (1950 – 1985) and the current database, the predecessor to MUD, the Radiation Dosimetry Records (RDR) database (1986 – present). The MUD database includes lifetime, cumulative, external radiation dose data for 49, 480 individuals. The MUD database will be obtained to identify those individuals exceeding established threshold for screening (i.e., 5 rem, 10 rem, 20 rem). In addition, an attempt will be made to determine whether a dosimetry file (developed by I. Aoki) can be retrieved.

Preliminary review of the Horan Occupational Radiation Dose Report (Horan, 1993) indicates that over 250 individuals from ICPP received in excess of 5 rem lifetime external dose. This report also suggests that the site with the greatest cumulative doses was the ICPP. The highest individual lifetime dose recorded is 79.1 rem. The highest ten individual lifetime doses ranged from 61.5 to 79.1 rem. It should be noted that none of these individuals were involved in any of the 4 accidents identified above. During risk mapping several individuals mentioned that "during the early years" it was common practice to not wear a dosimeter when the worker was likely to be approaching the regulatory limit. A 1969 Annual Health and Safety Report (IDO-12073) includes a summary of exposures from 1960 through 1969 and concludes "the occupational crafts receiving the highest exposures were mechanics, reactor technicians, and pipe fitters". This seems consistent with the Horan report findings. The number of workers exceeding the radiation protection guidelines (varied from 15 rem/yr to 5 rem/yr) was reported as 12 individuals. These exposures were all the result of accidents.

The Horan report and initial discussions with an individual in the Radiation Records Department suggest that exposure to internal emitters at the INEEL have not been extensive. Other references, along with risk mapping data, suggest that workers at the CPP process buildings and pilot plants had a high potential for internal exposure. (ACI-167) Current plans include reviewing records of dose reconstruction work that has been done (approximately 300 individuals). An assessment of the MUD data file will also be performed to determine if there is any association between internal dose monitoring (i.e., # of urine samples/yr, # of WBCs, etc) and cumulative external dose.

Finally, selection of individuals for medical screening should be based on lifetime doses (as recorded in the MUD database or the RDR database) based on a threshold lifetime dose. Further investigation will be conducted to determine who and where internal exposures were encountered and, if possible, to determine approximate magnitudes of lifetime doses associated with internal exposures.

A.2 Beryllium

The most broad-based use of beryllium on the INEEL site identified during this preliminary exposure assessment study was the use of beryllium as a reflector for neutrons in several reactors (MTR, ETR, ATR, EBR-II, ZPPR, ANP project, EBOR). The CDC chemical dose reconstruction report notes that in 1990 a SARA report indicates an inventory of 45,455 pounds of Beryllium Oxide. (CDC, 1998) It appears that the majority of this material exists as solid bricks used as reflectors in the various reactors around the INEEL site.

During the risk mapping sessions it was determined that beryllium machining was performed at various buildings at the INEEL site. Based on the preliminary review performed during this assessment the following buildings were identified as having including beryllium machining and or hand filing: TAN-607, ATR, ETR, MTR, WRRTF, and TRA-653. The job classifications associated with the reported exposures include: Machinists (Experimental Machinists (TAN) and Machinists (TRA)), Mechanics, Pipe fitters, Equipment Operators, Process Operators and Reactor Operators. The exposures reported associated with the ATR, ETR, and MTR were associated with the instillation of new beryllium during shutdown. During a risk mapping session, it was also indicated that in the TAN-607 (New Machine Shop) beryllium blocks were cut with a chop saw for purposes of disposal. In this case no protective equipment was being used.

In addition to beryllium machining and hand filing for use within reactors at INEEL, a review of the IH System 80 database identified building CF-689 as an area where beryllium surveys were being performed. Further review of the survey data sheet indicated that CF-689 Room 128 had been used for "Beryllium Thermocouple Fabrication" and that the operations performed included "trim, weld, and splice, braze and solder". The decontamination work and subsequent IH surveys were performed in 1989. However, no current information is available regarding the time frame of the beryllium thermocouple fabrication work.

A broad-based approach to defining the group potentially exposed to beryllium is recommended since published data (Newman 1989, Kreiss 1996) demonstrate that while there are job-related and exposure-related elevated risks for chronic beryllium disease (CBD), individuals with low-level exposure can be affected. For this reason a two-tiered approach is recommended based on exposure groupings.

For beryllium exposure at the facilities reviewed an attempt was made through the use of risk mapping to identify locations and job titles which were associated with beryllium use. Since the risk mapping efforts for this preliminary assessment focused on priority areas and buildings, we were not able to review all areas where beryllium was used. Locations and job titles relating to beryllium use are provided in Section V.

A.3 Lead

Potential exposure to and handling of lead was performed throughout the site. The primary use of lead on the site was as shielding materials, such as lead sheeting, lead pellets, and shot used for shielding and lead pipes. The lead shop at the CFA (CFA-687) was the only area identified where lead was melted and poured (recycling lead shielding). The lead shop housed two oil fired bottom poured lead pots along with accessory molds and pouring tables. Additionally, one instance where lead powder was used to repair cracks in shielding at the ETR reactor.

Risk mapping reports indicated that handling of shielding at the reactor facilities (including hand filing, sawing, etc.) was a common practice due to frequent changes in shielding configuration for various experiments housed at the reactor facilities. The handling of lead did not usually involve the use of PPE (especially during instillation when radiation issues were not a concern).

Limited quantitative data are available from several decades ago. The 1962 Annual report indicates that a "serious lead fume exposure condition occurred in a construction area". The incident involved nine lead burners working in a confined space at the bottom of a cement basin. Airborne levels of 30-85 times the TLV (0.2 mg / m^3) were identified by IH staff. Maximum blood lead level was determined to be 0.097 mg Pb / dl of blood; average urine was identified to be 0.416 – 0.600 mg Pb / liter of urine. Three of the men developed clinical symptoms of lead intoxication. The report also noted that these workers had performed similar type of work for many years.

Overall, the results of the risk mapping performed during this preliminary assessment identified the following buildings to be associated with potential high exposure to lead: CF-665 (Big Shop), CF-649 (Lead Shop), CPP-630 (Old Maintenance Building), TAN-607 (Hot Shop and Hot Cells), TAN-607 (Weld Shop), TR-603 (MTR reactor), TR-642 (ETR Reactor), and TRA-653 (Old Machine Shop). In addition, we identified the following job classifications to be associated with potential high exposure to: body men, decon techs, laborers, machinist, mechanics, pipe fitters, lead burners, process operators, and welders.

A.4 Mercury

At the ICPP, mercuric nitrate was used as a catalyst for the dissolution process (aluminum clad fuel elements). The mercuric nitrate was added to the dissolution process from the process make-up floor of the CPP-601 building. Reportedly, most of the mercury remained in solution with the raffinate, which was then sent to the WCF building for calcining. A safety analysis from 1963 estimated that 20% of the mercury introduced into the WCF with the feed might be vaporized and released to the air in the off-gas. For "commonly processed waste" this was estimated to yield concentrations of approximately 0.007 mg/m^3 (TLV for mercury vapor is currently 0.05 mg/m^3). IH data for the WCF building was not identified. (CDC)

Mercury was also used at the TAN facility in association with the ANP program. The mercury was used during the testing of the D102A turbojet engine reactor system and was used for shield augmentation. A large mercury spill in 1958 was detected during routine health physics surveys 30 years later in 1988. A removal action was performed in 1995. (CDC CHEM) During risk mapping activities, retirees recalled frequent "small" spills of less than 1 gallon of mercury along the rail tracks and within the building (TAN-607). The CDC report also references interviews with past ANP workers who estimated that total mercury used during the ANP project to be approximately 50 tons.

Overall, the results of the risk mapping performed during this preliminary assessment identified the following buildings to be associated with potential high exposure to mercury (or mercuric nitrate): CPP-601, CPP-633, CPP-630, CPP-602, and TAN-607. In addition, the following job classifications were identified to be associated with potential high exposure to mercury: helpers, decon technicians, hot shop technicians (TAN-607), and instrument technicians.

A.5 Cadmium

Cadmium exposures were reported as cadmium sulfate and cadmium nitrate within the Chemical Processing Plant. The cadmium compounds were reportedly used as "poisons" added to the process during dissolution of fuel elements. The cadmium compounds were reportedly used only for the zirconium clad fuel elements from the Naval Nuclear Reactor program. Originally, this process was housed within CPP-601 (the E-Cell) and was later moved to an upgraded facility known as the FAST facility (CPP-666) in 1985. The primary exposures reported were associated with the process make-up area. Based on discussions with current workers and retirees it was determined that a FAST pilot project was conducted within Building CPP-637 (Multi-curie cell) and pilot testing (cold pilot runs – no radioactive material) may have also been conducted in building CPP-627.

Some IH data is available for the FAST process building (HP-3000 Database at ICPP) which, based on a preliminary scan, appears to include primarily results of below detectable limits. A copy of this database has been requested from the contractor and will be reviewed further. Additionally, further investigation is necessary to determine whether cadmium exposures were more extensive during the pilot testing of the FAST process. Further investigation is necessary to determine the buildings and job classifications associated with exposure to cadmium. However, based on risk mapping conducted to date, it appears that the following job classifications would have the greatest potential to exposure to cadmium: operators and helpers at CPP.

A.6 Chromium

Chromium exposures were reported during risk mapping sessions from various manufacturing operations. At the Chemical Processing Plant, chromic acid (CrO3 and CrO4) was used within the dissolution process. High exposures were reportedly associated primarily with operations on the Process Make-up floor of CPP-601 and also at CPP-627 and CPP-637. At the Central Facilities Area, high exposures were reported within the machine shop (machining operations) and within the big shop. At the TAN facility, high exposures were reportedly related to machining operations. Overall, the results of the risk mapping performed during this preliminary assessment identified the following buildings to be associated with potential high exposure to chromium compounds: CF-665 (Big shop), CF-640 (Machine Shop), CPP-601, and TAN-607 (Machine Shop). We also identified the following job classifications to be associated with potential high exposure to chromium compounds: helpers, machinists, and body men.

A.7 Hydrofluoric Acid

Hydrofluoric acid exposures were reported during risk mapping sessions for the ICPP facility, especially in the dissolution operations (CPP-601), the FAST dissolution operations (CPP-666), and at CPP-627 and CPP-637. Reportedly HF was also used for dissolution of Zirconium clad fuel elements. We also identified the following job classifications at ICPP to be associated with potential high exposure to HF: operators, helpers, mechanics, instrument technicians, and HP technicians.

A.8 Nitric Acid / Nitrogen Oxide

Nitric acid was primarily reported during risk mapping activities at the CPP facility. Nitric Acid was extensively used during dissolution of aluminum clad fuel elements. Handling of the concentrated Nitric Acid on the Process Make-up floor of the CPP-601 and CPP-633 buildings appears to have been the source of the greatest exposures. Risk mapping participants reported "constant noticeable fumes" on the process make-up floor of CPP-601.

Nitrogen oxides, primarily nitrogen dioxide, are formed during the decomposition of nitrates in the waste solution that is calcined at the WCF building (CPP-633). Overexposures to oxides of nitrogen were reported in 1968 Annual Health and Safety Report.

Overall, the results of the risk mapping performed during this preliminary assessment identified the following buildings to be associated with potential high exposure to Nitric Acid / Nitrogen Oxide (see Appendix B of Section V): CPP-601, CPP-633, CPP-627 and CPP-637, and TAN-607 (Decon Shop). In addition, the following job classifications were associated with potential high exposure to nitric acid /nitrogen oxide: operators, helpers, mechanics, instrument technicians, pipefitters, welders and HP Technicians (all from the CPP facility) and decon technicians (TAN-607).

A.9 Chlorinated Solvents

Chlorinated solvents, especially carbon tetrachloride, methylene chloride, and TCE, were used throughout the site. Uses reported included parts-degreasing and general area decontamination. The facilities where potential high exposures to chlorinated solvents was most frequently reported in risk mapping sessions were the TAN facility and the TRA facility. In particular, the following buildings were associated with potentially high exposure to chlorinated solvents: CPP-602 (Instrument Shop), CF-654 (Paint Shop), TAN-607 (Decon Shop, Pipe Laundry Area, Hot Shop 101), TRA-603 (MTR), and TRA-642 (ETR). The following job classifications were associated with potentially high exposure to chlorinated solvents: instrument technicians (CPP), painters (CFA), mechanics, pipe fitters, welders, laborers, electricians and decon technicians (TAN) and laborers, mechanics, process operators, and reactor operators (TRA).

A.10 Noise

Noise exposures were reported throughout the INEEL site. However, based on risk mapping sessions, the process areas where highest noise levels existed were infrequently occupied. Machine shops at CFA, TRA and TAN were all reported to have high noise levels along with significant occupancy.

The following buildings were reportedly associated with potential high exposure to noise: CF-640 (Machine Shop), CF-649 (Lead Shop/ Old Weld Shop), TAN-607 (Pipe Shop and Machine Shop), TRA-670 (ATR – Diesel Generator Pit), TRA-603 (MTR), TRA-642 (ETR) and TRA-653 (Machine Shop). The following job classifications were associated with potentially high exposure to noise: machinists, mechanics, process operators (TRA), pipefitters (TAN) and welders.

A.11 Asbestos

Asbestos insulation was used extensively in the 1950's when many facilities at the INEEL were initially constructed. Asbestos-containing materials are found in roofing, pipe and vessel insulation, building insulation, gaskets, packing, siding and other building materials. Asbestos exposure may also have occurred in relation to work with asbestos blankets and asbestos gloves. In addition, mechanics working at the CFA Big Shop were exposed to asbestos during brake work on buses and other site vehicles.

Exposure to asbestos was reported at all of the facilities reviewed during risk mapping, especially among the following job classifications: decontamination technicians, instrument technicians, insulators, mechanics, pipe fitters, and operators.

A.12 Welding Fumes

Welding fume exposures were reported throughout the INEEL site. The exposures reported during risk mapping activities include exposures within the maintenance shop buildings and during field work (i.e., maintenance work, new construction work, or system modification work).

The 1969 Annual Health and Safety report mentions a special pulmonary function testing program for 38 welders involved in the LOFT project at the TAN facility. Three individuals in this group were reported to have abnormal results. (IDO-12073)

CF-649 (Old Weld Shop), CPP-630 (Old Weld Shop), TAN-607, TRA-670 (ATR), TRA-603 (MTR), TRA-642 (ETR), and TRA-653.

Overall, results of the risk mapping performed during this preliminary assessment identified the following job classifications to be associated with potential high exposure to welding fumes (see Appendix C and D): machinists, mechanics, pipefitters and welders.

B. Questionnaire Results

The above-cited agent-specific analysis is principally the results of the risk-mapping sessions in combination with limited industrial hygiene and radiation monitoring data. We also sent a questionnaire to a broad cross-section of retirees and terminated workers (n = 1,000) and have, to date, received nearly a 50% response rate. A full description of the methods and results of this questionnaire is available in Section VII in Part II of this report.

A seven-page questionnaire was developed (Section VII, Appendix A) that requested information on demographic status; history of job title, exposures, and job locations at INEEL; health concerns; current health care; and interest in screening and education. A check list of 35 specific exposures were included in the questionnaire. A copy of the questionnaire was sent to the 1,000 individuals that represented a stratified random sample of retirees and terminated workers from INEEL and of retirees from Argonne West

Of the 1,000 questionnaires sent, 62 (6%) were returned by the U.S. Postal Service due to incorrect address. Of the remaining 938 individuals, we received 450 (48%) completed questionnaires. There were 7 questionnaires returned from family members of former INEEL workers indicating that the workers had died.

Most (80%) of the questionnaires respondents were retirees from INEEL or Argonne West. Two-thirds of respondents were between ages 60 and 79, with the remaining one-third was evenly divided between workers aged 59 or less or ages 80 and over. Three-quarters (77%) of the respondents live in Idaho. An additional 10% (n=47) of the respondents lived in states that the border with Idaho, including Montana, Wyoming, Nevada, Utah, Oregon, and Washington. Of note is that only 27% (n=111) of respondents had been members of OCAW. Information about membership in other unions at the facility was not requested.

Table I-2 lists the exposures and their reported frequencies on the completed questionnaires. External radiation exposure was reported by almost one-half of the respondents (45%, n=205). One-fifth of respondents reported exposure to acetone, asbestos, and noise. Additional common exposures, defined as greater than or equal to 10% of respondents reporting exposure, were internal radiation, acids (i.e. - nitric, sulfuric, hydrofluoric, and hydrochloric); cutting oils; welding fumes; mercury; and carbon

Table I-2
Most Commonly Reported Exposures among Former INEEL Workers

Chemicals and Agents	No. of Respondents Reporting Exposure	%
External Radiation	205	44.9%
Acetone	97	21.2%
Noise	92	20.1%
Asbestos	91	19.9%
Internal Radiation	65	14.2%
Nitric Acid	60	13.1%
Cutting Oils	59	12.9%
Welding Fumes	57	12.5%
Sulfuric Acid (Battery Acid)	57	12.3%
Mercury	52	11.4%
Carbon Tetrachloride	51	11.2%
Hydrofluoric Acid (HF)	46	10.1%
Hydrochloric Acid (HCL)	45	9.8%
Heat	41	9.0%
Paint or Paint Thinners	40	8.8%
Cadmium	37	8.1%
Dusts (Wood, Coal, Fibers)	35	7.7%
Beryllium	33	7.2%
Trichloroethane	33	7.2%
Other	32	7.0%
Sodium Hydroxide	30	6.6%
Chlorine	29	6.3%
Copper	29	6.3%
Freon	29	6.3%
Benzene	26	5.8%
Chlorinated Solvents	24	5.3%
Chromium or Chromic Acid	24	5.3%
Methyl Ethyl Ketone (MEK)	24	5.3%
Repetitive Motion, Vibrations	22	4.8%
Nickel	15	3.3%
Silica	15	3.3%
Fluorine	12	2.6%
Methylene Chloride	11	2.4%
Arsenic	5	1.1%
Acrylonitrile	4	0.9%
Phosgene	4	0.9%

tetrachloride. Beryllium exposure was reported by 7% of respondents. Cadmium exposure was reported by 8% of respondents.

We also examined how many respondents reported exposure to at least one of the following agents: asbestos, acids (nitric, sulfuric, hydrofluoric, and hydrochloric), beryllium, mercury, chromium, cadmium, nickel, welding fumes, benzene, cutting oils, carbon tetrachloride, trichloroethylene, and trichloroethane. Over one-third (36%) of the respondents reported exposure to at least one of these agents. This percentage increases to 40% if noise is added to the list of exposures. Note that radiation and lead are not included on this list. (Lead was inadvertently omitted from the questionnaire.) Over one-half of questionnaire respondents reported exposure to at least three of the agents on the above-cited list.

Table II-3 provides the breakdown of questionnaire respondents by work site at INEEL. Approximately 1/3 of respondents reported having worked at CFA, TRA, or ICCP. An additional one-quarter of respondents reported working at TAM and IF. Of note is that individuals usually worked at more than one site at INEEL so that the exposures occurred over multiple sites.

Table I-3
Facilities Where Questionnaire Respondents Worked

Facility	No. of Respondents Reporting Work	%
CFA	180	39.5%
TRA	172	37.7%
ICPP	171	37.5%
TAN	146	32.0%
IF	118	25.9%
AW	85	18.6%
ARA	56	12.3%
PBF	53	11.6%
RWMC	50	11.0%
NRF	50	11.0%
OMRE	4	0.9%
AEC	2	0.4%
EOCR	2	0.4%
WRF	2	0.4%

We also obtained information about job titles that respondents had over their careers at INEEL. Over 300 job titles have been cited. We are currently aggregating these job titles in order to better characterize common exposures among similar job titles.

C. Nature and Extent of Health Impacts Experienced by INEEL Workers

There has not been any epidemiological study of INEEL workers. The NIOSH cohort mortality study is ongoing, but will not be completed for some time.

The only morbidity survey that we could identify was a cross-sectional study of asbestos-related fibrosis among 119 long-term INEEL workers ($\geq$ 20 years since onset of employment). It was sponsored by a law firm. Chest films were read by a B reader. Of the 119 workers examines, 20 (17%) showed parenchymal and/or pleural scarring on the chest x-ray that was characteristic of previous asbestos exposure. While the validity and representativeness of this survey is difficult to determine, the prevalence of abnormal chest-rays found in the survey is typical for maintenance workers in similar industrial settings. It is also compatible with the common report of asbestos exposure from the risk-mapping sessions and the questionnaire responses.

D. Educational Needs and Health Concerns of Former Workers

We have two sources of information on the health concerns, health care, and educational needs of former INEEL workers: the focus groups and the questionnaire results.

D.1 Focus Group Results

The focus groups were invaluable in providing insight about how former workers viewed the "significance" of their prior exposures, and their current state of knowledge, health concerns, and health care. Inclusion of 23 workers, most of whom had more than 25 to 30 years of employment at INEEL, provided a broad spectrum of opinion. A wide range of job titles were represented in the groups.

The following themes arose during the two focus group sessions:

- Participants believe a serious health risk exists for them because of unsafe conditions in the industry in the early years (ie. 20 years ago). Concern about cancer was especially high.
- In the early years, the management/government responsible for the facility did not do enough to protect the workers.
- Participants felt angry that physicians at the facility inadequately cared for their occupationally related health concerns.
- Former workers expressed concern for new (current) workers and wanted their experience at INEEL to be safer.

For the purposing of designing a medical surveillance program, the following observations were made about current health care:

- Former workers are generally conscientious about current medical care despite insurance limitations.
- Focus groups expressed trust and a preference for their personal physicians and distrust of occupational physicians.
- Personal physicians do not have enough information about occupationally-related illnesses.
- There was a positive feeling toward participating in a health program.
- Focus group participants expressed very positive feelings about participating in a health program and felt co-workers would feel the same way.
- Education about occupational exposures should be provided to the former workers.

- Participants want the health program to portray the nuclear power industry in a positive light

- Former workers may deny that they by have health problems.

- Former workers may distrust the program if it is being run by INEEL or DOE.

As part of Phase I, we have also constructed community inventories of health and community organizations that can be used in planning and implementing Phase II.

Additional detail regarding these issues is provided the complete analysis by Susan O'Brien in Section VI of Part II of this report.

D.2 Questionnaire Results

Most respondents reported to be in fine health. Three-quarters of the respondents reported that they had seen a physician during the 12 months prior to completing the questionnaire (n=348, or Y%). Three-quarters of respondents reported having a personal physician. Two-thirds of respondents (n=300, Y%) reported that they have periodic checkups when they are not ill. Indeed, 90% of these respondents who report having regular checkups had a checkup during the 12 months prior to completing the questionnaire. The vast majority of respondents have health insurance (n=392, or 86).

When asked whether they were concerned that their health might have been affected by working at INEEL, 40% (n=164) reported that they were somewhat or very concerned about this issue. The remaining 60% (n=248) reported that they were not concerned that their health was affected by working at INEEL. On the other hand, the majority of the respondents were interested in participating in a medical screening if offered. Nearly 60% of respondents (n=242, or 59%) stated that they were somewhat to very interested in participating in a screening.

The majority of respondents reported that their personal physician knew that they had worked at INEEL. However, when asked if their personal physicians were aware of their specific exposures that they had had at INEEL, the vast majority (295, or 78%) reported that they did not believe that their physician was aware of the specific exposures that they had had at INEEL.

Additional details on questionnaire methods and result can be found in Section VII of Part II of this report.

E. Size of the Target Population

Estimating the size of the target population naturally requires defining what the target population is. In the following section, we provide the rationale for a targeted medical surveillance program that meets the criteria established by the Department of Energy. If requested, we will submit a full plan for Phase II, which will describe in detail the rationale and design of a medical surveillance and risk communication program.

To fulfill the mandate for medical surveillance established by the DOE, we will propose a medical monitoring program designed to detect and to reduce the burden of chronic lung disease, cancer, kidney and liver disease, and hearing loss.

- **Preventive Pulmonary Health** Workers at INEEL are likely to be at increased risk of a variety of lung diseases, including chronic obstructive lung disease, pneumoconioses, and lung cancer. They worked with a variety of irritants, fibrogenic dusts and lung carcinogens (asbestos and beryllium, at a minimum). It is justified to include all workers with significant exposures to lung irritants, asbestos and beryllium in a medical screening and risk communication program. Since several of these agents were in widespread use at INEEL, large numbers of INEEL workers were likely to have experienced these exposures.

- **Cancer Detection program** Some former workers had excessive exposure to external radiation and probably to internal radiation as well. Such workers would benefit from a targeted cancer detection and education program.

- **Hearing Loss** While excessive noise exposure occurred at selected parts of the INEEL complex, large numbers of workers were apparently not employed in those areas. For workers who were in those areas, a hearing testing program would be justified and beneficial.

- **Diseases of Other Organs** Exposure to metals and solvents was common at INEEL. Screening for kidney and liver disease would be appropriate for such workers. For lead-exposed workers, it may also be useful to examine the bone lead level, in order to determine whether an appreciable exposure occurred in the past. Such information would help determine whether screening for lead-related outcomes is appropriate.

These screening program elements and targeted conditions are entirely consistent with the currently-funded DOE former worker medical surveillance programs at other sires and with the national medical screening protocol established by DOE for this program.

Results of the risk-mapping exercises yield observation on which facilities, buildings and job titles appear to be associated with the greatest likelihood of significant levels of specific exposures. The details were provided in a previous section and also in Section V of Part II of this report. Unlike our work at the gaseous diffusion plants, we do not currently have a former INEEL employee roster that also includes information on facility, building, and job title according to individual employee. We cannot yet sort former employees by these variables that would us to identify a group at highest risk of significant exposure and risk of disease. The roster database that NIOSH is compiling may provide some of this information but probably not for workers who were first hired prior to 1983.

According to the results of the questionnaire, 36% of the sampled workers reported exposure to at least one of the following agents: asbestos, beryllium, numerous acids, TCE, trichloroethylene, (add addl exposures). An additional 4% of workers who did not report any of the above exposures reported noise exposure. Of note is that radiation and lead were not included in the above group of exposures. (Lead was inadvertantly omitted from the questionnaire.) If these two exposures are added, the percentage of workers who reported exposure to at least one of these targeted exposures is probably 45% to 50%. This would be the group that would be targeted for the proposed medical screening program.

We currently have a roster of retirees and terminated (since 1994) workers from Lockheed-Martin and of retirees from Argonne West. The total is 5,154. This is the population, from which we sampled 1,000 people to whom to send a questionnaire. If 45% to 50% are eligible for screening due to exposure as described above, then the size of the population to be screened would be 2,320 to 2,575.

As part of the NIOSH mortality study, Utterback has developed estimates of the number of INEEL employees by major facility and vital status. estimates that there were approximately 105,000 individuals who ever worked at INEEL, including 15,000 to 17,000 Navy sailors who spent some time at the Naval Reactor Facility (NRF). Deleting these sailors leaves a cohort of approximately 90,000 workers. He believes that there were about 5,000 additional workers who ever worked at NRF, not including employees of sub-contractors at NRF. He further estimates that there were roughly 30,000 construction workers, including major and minor construction sub-contractors, who ever worked at INEEL. The range of workers ever employed at Argonne West is 5,000 to 10,000, including 1,800 workers as of 1992. The majority of the remaining workers, that is, 40,000 to 50,000 workers, were principally employed by the succession of prime contractors, most recently, Lockheed Martin. This estimate includes the 12,000 workers who were employed as of 1992, and the 8,000 who are currently employed.

Dr. Utterback estimates that about 15% of this workforce has died and has identified thus far roughly 10,000 actual deaths, using the National Death Index and SSA records.

As part of the NIOSH database at INEEL, sequential job titles are available for INEEL employees beginning in 1983. Prior to 1983, only initial job titles (at the date of hire) are available. At NRF (which is not part of our project), additional detailed information is available. The IBM tapes that have the dosimetry data have additional information on job location and possible job title, but NIOSH has not yet used these tapes and does not plan to do so in this phase of the cohort mortality analysis. The NIOSH database is not yet ready for use outside of the cohort mortality analysis for which it was created. Estimate date of readiness is mid-1999.

From the NIOSH data, there appears to be a significant number of former workers who may be alive but for whom we have not yet identified the names and addresses for inclusion in the roster of former workers. As noted above, Utterback estimates that there have been roughly 40,000 to 50,000 workers who have been employed by the prime contractors over the history of INEEL, including current workers, who number 8,000 to 10,000. If approximately 15% of these workers have died, it suggests that there should be 25,000 to 35,000 workers who are still alive who are former INEEL workers. If 45% to 50% have had at least one of the targeted exposures, then the size of the group targeted for screening would be in the range of 11,000 to 17,500. This is obviously much higher than the lower range cited above. Many of this discrepancy may be due to the fact that we do not electronic lists of workers terminated prior to 1994. There is considerably more uncertainty attached to the higher part of the range. When NIOSH is able to release its master roster (expected in 1999), some of this uncertainty may be reduced.

It is reasonable to initiate the screening program with the roster of 5,154 workers that we currently have. This roster includes the retirees from Lockheed-Martin and from Argonne West and is, therefore, likely to represent many of the workers with the longest duration of employment at INEEL.

Given the incompleteness of information available at present, the estimate of the size of the population at risk must be regarded as approximate. It is, however, sufficient for planning purposes and can be refined in 1999 when NIOSH data become available.

IV.. NEED FOR MEDICAL SURVEILLANCE AND RISK COMMUNICATION

The results of the 12 month needs assessment study support the need for a medical monitoring and risk communication program. This conclusion is based on the evidence that large numbers of workers had exposures to detrimental agents and the strong need expressed by former workers for a credible targeted program of medical surveillance and education. While there have been no specific epidemiologic studies at INEEL that would inform us about risks, the toxicity of the exposures at INEEL are sufficiently well-known to allow establishment of a rational screening program.

In Phase II, we propose to develop and implement a health protection and risk communication program for INEEL workers centered on the workers at risk for 1) chronic respiratory disease, including chronic obstructive lung disease (COPD) and the pneumoconioses, 2) cancer, 3) kidney and liver disease, and 4) hearing loss. We select these conditions, because they meet the criteria established by the DOE for medical monitoring and risk communication. Our logic is two-fold. First, these diseases are caused by exposures that have occurred at INEEL. Second, a medical monitoring program framed around these conditions can provide tangible benefits. It can lead to early detection of cancer, which can increase survival and quality of life. A well-designed program can identify COPD and the pneumoconioses for which advice about proper treatment (COPD), vaccinations, and prompt treatment of superimposed infections will be highly beneficial. Lung cancer is not yet amenable to early detection through rational screening, but smokers can be enrolled in smoking cessation programs, thereby reducing both occupational and non-occupational risks. The severity of kidney and liver disease can be reduced by control of other risk factors (e.g. – hypertension and alcohol consumption).

The risk communication will be a centerpiece of a health protection/medical monitoring program. While there remains considerable uncertainty about the health risks experienced as a result of working at INEEL, this uncertainty must be openly communicated by credible sources. In combination with a medical surveillance program designed to protect health, accurate information about risks will be itself health promoting. We propose the hard outcomes noted above for medical monitoring, in part, because they can be identified with certainty. The health outcomes that we seek to include a monitoring program are highly amenable to screening on a population basis. After participation in the screening program, former INEEL workers will have increased real knowledge about their personal health status, what is known about their risks, and how they can promote their own health. In conclusion, mounting such a program in Phase II should make a tangible improvement in people's lives.

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Section V

REPORT ON EXPOSURE ASSESSMENT AND RISK MAPPING RESULTS

Appendices:

Appendix A: Risk Mapping Results
Appendix B: Risk Map Exposures
Appendix C: High Exposure Ranking Matrix
Appendix D: Average Dose Factor Matrix

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I. DESCRIPTION OF INEEL FACILITIES

The Idaho National Engineering and Environmental Laboratories (INEEL) (formerly the INEL and the National Reactor Testing Station) was established in 1949 as a place where the US Atomic Energy Commission could build, test, and operate various types of nuclear reactors, allied plants and related equipment. The INEEL has been one of the nation's centers for developing uses for atomic energy. The INEEL site included the world's largest and most varied collection of reactors: research, testing, power, and propulsion.

Centered on a former Naval Proving Grounds which served the Navy's Pocatello (Idaho) Ordnance Depot, the INEEL covers some 572,000 acres of sagebrush land on the Snake River Plains in Southeastern Idaho. Most of the site lies in Butte County although it also extends into Bingham, Bonneville, Jefferson, and Clark Counties. Its 894 square mile size (3/4 the size of Rhode Island) enabled scientists to carry out nuclear experiments that they could not have in a populous area. (Figure 1)

The following sections briefly describe 16 major facilities at the INEEL site. These facilities are as follows:

1. Idaho Chemical Processing Plant (ICPP),
2. Test Area North (TAN),
3. Test Reactor Area (TRA),
4. Central Facilities Area (CFA),
5. Argonne National Laboratory- West (ANL-W),
6. Radioactive Waste Management Complex (RWMC),
7. Power Burst Facility (PBF),
8. Naval Reactor Facility (NRF),
9. Auxiliary Reactor Area (ARA),
10. Argonne National Laboratories-West (Original Location which included the Boiling Water Reactor Experiment (BORAX) and the Experimental Breeder Reactor I (EBR-I)),
11. Waste Reactor Research Test Facility (WRRTF),
12. The Army Above Ground Radiation Testing (ARVFS) program,
13. The Idaho Falls Laboratories,
14. The Experimental Organic Cooled Reactor,
15. The Experimental Dairy Farm, and
16. The Naval Ordinance Test Facility (NOTF).

The description of the facilities includes a brief history of the facility, a brief description of the activities at each facility and for those facilities identified as priority facilities (ICPP, TAN, CFA, TRA, and ANL-W), during retiree risk mapping sessions, a more in-depth description of primary buildings of concern and occupational exposures.

Idaho Chemical Processing Plant (ICPP)

Since it began operations in 1953, the ICPP has been the principal facility for the receipt, interim storage and reprocessing of spent nuclear fuels. The ICPP also manages high-level radioactive solid waste from other DOE facilities and all wastes generated at the ICPP. In 1992, DOE announced that the ICPP would no longer process spent fuel although its interim storage function for radioactive wastes would remain. The facility was also directed to develop remediation technologies for radioactive environmental contamination.

The spent nuclear fuels which are stored at the ICPP come from the naval propulsion program and other INEL research reactors including MTR and EBR-II. The fuel is transported to the ICPP by truck where it is unloaded and then placed in storage in either dry containers or in water filled basins.

Fuel processing at the ICPP was initiated in 1952 in the processing plant (CPP-601). By the mid-1980s the facility had multiple capabilities for dissolving several types of nuclear fuels with various cladding including aluminum, zirconium, stainless steel, graphite and ceramic. In general, the process involves the dissolution of the fuel rod in an appropriate acid followed by liquid-liquid extraction with an appropriate solvent to separate the uranium from the cladding material and the fission products and transuranic elements with which it is associated in the fuel elements. The uranium is then solidified and transported to the Oak Ridge National Laboratory.

Prior to 1963, liquid wastes (containing transuranics and fission products) generated during fuel processing were concentrated by evaporation and stored as liquids in large underground stainless-steel tanks. The Waste Calcining Facility (CPP-633) was constructed in 1963, to convert high-level radioactive liquid waste to more stable, solid, calcined granules, using a fluidized bed process (developed at the ICPP). The waste calcining facility was shut down in 1981, and subsequently replaced with the New Waste Calcining Facility (CPP-659) in 1983. The new process involved spraying liquid waste onto coarse granules in an oven. After the calcine was formed the granules were transported through pneumatic tubes by airstream to underground storage bins.

The ICPP also contains the Rare Gas Plant that recovers krypton-85 from the processing of spent nuclear fuel. The krypton is shipped to Oak Ridge National Laboratory where it is sold for commercial purposes.

A more detailed description of fuel reprocessing and the calcining process are included within section IV of this report.

Test Area North (TAN)

Situated approximately twenty-seven miles north of the CFA in the northern half of the INELs territory, TAN was established in the early 1950's to support the joint Aircraft Nuclear Propulsion program of the US Air Force and the Atomic Energy Commission.

Areas of primary concern at the TAN facility include: the Initial Engine Test (IET) area, the Loss of Fluids Test (LOFT) facility, the Specific Manufacturing Capabilities (SMC) project, the general shops and Hot Cells (TAN-607), and the Hot Cell Annex.

The IET operated from 1961 through 1967 as part of the Space Nuclear Auxiliary Power Transient program. This program investigated beryllium-reflected reactor performance under varying environmental conditions. Between 1966 and 1967, the IET area was inactive. In 1977 the facility was used for decommissioning a reactor from Nebraska. Since 1978 the facility has been inactive.

The Loss-of-Fluid Test reactor was established to perform loss-of-coolant experiments under simulated accident conditions. This reactor was a small-scale model of a commercial pressurized water reactor used to test accident conditions. This facility operated from 1965 through 1975.

The Specific Manufacturing Capabilities (SMC) project produces armor plate from depleted uranium for the US Army. Most of the operations occur in a converted airplane hangar and one other more recently constructed building. This project has been in operation from 1986 to present.

Primary exposures of concern at the TAN facility included: external and internal radiation, mercury (used in IET), beryllium (machining and use in IET, EBOR, and WRRTF), lead, welding fumes, asbestos, and chlorinated solvents.

It should be noted that the SMC facility, currently housed in former IET airplane hanger, was not reviewed as part of this assessment.

Test Reactor Area (TRA)

The Test Reactor Area (TRA) provided facilities for testing the performance of reactor materials and equipment components in environments of high neutron flux, which allowed scientists to obtain information essential for new reactor design. For the most part the experiments involved static irradiation (in capsules) or dynamic irradiations (in loops).

Originally started in the early 1950s, with the building of the Material Test Reactor, the TRA has since seen two additional test reactors built, the Engineering Test Reactor (ETR), as well as the Advanced Test Reactor (ATR). There are currently 80 buildings at the TRA that provide space for reactors, analytical chemistry and radiation laboratories, and maintenance and support service buildings.

The Materials Test Reactor (MTR) was built in 1952, to provide the capability for irradiating fuels and materials test samples and to provide neutron beam sources for basic research. The MTR used a variety of Fuel elements ranging from 20% enriched Uranium – 93% enriched Uranium and Plutonium-239 fuel elements. The MTR was permanently shut down in 1970.

The Engineering Test Reactor (ETR) was constructed in 1957 with full power achieved in 1958. The ETR grew out of the need for more high flux testing space as well as capability of "through the core" testing which allows for irradiations within the high flux area of the core itself. The bulk of this need was for evaluation of fuel, coolant, and moderator characteristics under different environments. The ETR complex also included the Engineering Test Reactor Criticality Facility (ETRC). This reactor was a small-scale version of the ETR that was used to mock up all experiments prior to being run at full power on the ETR. Both the reactor and its associated support facilities have been inactive since 1982.

The Advanced Test Reactor (ATR) was completed in 1965, and initially started up in 1967. The ATR began operation at full power in 1969. The ATR was designed to provide an extremely high neutron flux for a multiplicity of high-pressure loops. The ATR is a light water moderated and cooled system. The ATR complex also included an Advanced Test Reactor Criticality Facility (ATRC) which served a similar purpose as the ETRC. The ATR complex was originally constructed to continue the irradiation programs being performed by the ETR.

Additional facilities at TRA include: 1) the TRA Hot Cells Facility, equipped for the remote handling and metallurgical analysis of radioactive materials; 2) TRA Machine Shop, 3) Gamma Irradiation Facility, and 4) Metallurgical Research Facilities.

Central Facilities Area (CFA)

The CFA is the oldest site at the INEEL complex with some US Navy military activities beginning in the early 1940s. In addition to the various administrative functions presently performed at the CFA, it also includes laboratories, security and fire operations, medical facilities, communications operations, warehouses, vehicle and equipment pools, a maintenance shop, a bus system and laundry facilities. Currently, approximately 1000 people are employed there.

Buildings of particular interest are outlined within section IV.

Argonne National Laboratory-West (ANL-W)

Construction of the Experimental Breeder Reactor-I began in 1949. Since the inception approximately 2000 employees have worked at ANL-W and presently it employs approximately 800 individuals.

Primary facilities of interest at the ANL-W include: 1) Experimental Breeder Reactor-II (1961-1996), 2) the Fuel Conditioning Facility (FCF), 3) the Hot Cells (Hot Fuel Examination Facility (HFEF) and the Junior Caves), 4) the Zero Power Physics Reactor (ZPPR), 5) the Transient Reactor Test Facility (TREAT), 6) the Fuel Manufacturing Facility (FMF), Machine Shops and Weld Shops.
A more detailed description of the primary buildings is included within section IV.

Argonne National Laboratories-West (ANL-W) Original Site

The primary facilities of interest at this site include The Boiling Water Reactor Experiment (BORAX) reactors: BORAX I-V that operated from 1953 through 1964, the Experimental Breeder Reactor-I (EBR-I) which operated from 1949 through 1964, Zero Power Reactor –3, a Hot Cell Facility, a machine shop and a weld shop.

Radioactive Waste Management Complex (RWMC)

The RWMC mission has three primary components: 1) to provide waste management of transuranic contaminated solid, and low-level radioactive wastes, 2) to retrieve, examine, and certify stored transuranic waste for ultimate shipment to the DOE Waste Isolation Pilot Plant in New Mexico; and 3) to provide research and development, including demonstration projects in waste management.

The RWMC began operation in 1952, as a 13-acre disposal site for the burial of solid radioactive waste in trenches. In 1954, the RWMC also began accepting transuranic wastes from Rocky Flats. In 1957, the site was enlarged to 88 acres and from 1960 to 1963, the RWMC accepted beta-gamma waste from private sources.

The Transuranic Storage Area was established in 1970 for interim storage of transuranic wastes and was enlarged to its present size in 1986.

Power Burst Facility (PBF)

The PBF was originally designed for testing transient behaviors of nuclear fuels and performing other safety studies of light-water moderated enriched fuel reactor systems. Four experimental reactors, known as Special Power Excursion Reactor Tests (SPERT) I-IV, were constructed during the 1950s and early 1960s. The last PBF reactor, SPERT IV, was shut down in 1970. The PBF is currently divided into five areas: 1) the PBF control area, 2) the PBF Reactor Area, 3) Waste Engineering Development Facility, 4) Waste Experimental Reduction Facility and 5) Mixed Waste Storage Facility.

SPERT I was constructed in a below grade pit and it began testing in 1956. The reactor was decommissioned in 1964, and the pit demolished in 1985.

SPERT II started operation in 1960, becoming chronologically the third functioning reactor at the PBF. It was designed to study the influence of prompt neutron lifetime on reactor transient behavior by using various moderators, or reflectors. Four years later, in 1964, SPERT II was placed on standby status, and subsequently decommissioned in 1980, when many of its components were removed. The facility was modified in 1986.

SPERT III became operational in 1958. It was designed to study behavior in high-power, high temperature, heterogeneous light water reactors. The reactor was placed on standby status in 1968, and decontaminated in 1980.

SPERT IV became operational in 1961. It was a large pool type facility, built to extend the range and type of controlled test parameters, and to provide a facility for the kinetic testing of reactor cores. The reactor was eventually placed on standby status in 1970.

The present PBF reactor was built in 1970 and was put on standby status in the mid 1980s.

Naval Reactor Facility (NRF)

Located near the center of the INEEL territory, the NRF has been in existence since the laboratory's earliest days. Four major installations originally comprised the NRF: 1) Submarine Prototype (S1W), 2) the Large Ship Reactor (A1W), 3) the Expended Core Facility (ECF), and 4) the Natural Circulation Reactor (S5G). The facility performs research and development for naval propulsion nuclear reactors and serves as a training site for naval nuclear reactor operators. Approximately 800 civilian workers and a comparable number of US Navy personnel are currently employed at NRF.

All employment, and health and safety information for the NRF is maintained independently of other INEL contract organizations. DOE oversight for the NRF is through the Pittsburgh Naval Reactor Office.

Auxiliary Reactor Area (ARA)

The ARA program consisted of four areas, ARA-I through ARA-IV. The program was established in 1957 and ultimately phased out by 1965. The reactors associated with each area are summarized below:

ARA-I – Compact Power Reactor (mobile reactor which could undergo quick shutdown and startup)
ARA-II – Stationary Low Power Reactor-I (SL-I) (Reactor accidentally destroyed in '61 killing 3 workers)
ARA-III- Army Gas Cooled Reactor Experiment
ARA-IV- Mobile Low Power Plant-I (portable gas cooled, water moderated power reactor)

Idaho Falls Facilities

The INEEL employs approximately 4000 people who work in 35 buildings that are scattered through the city's business district. The primary mission of the Idaho Falls facilities is to provide technical, analytical and administrative support and oversight. These facilities include: INEL Research Center (approximately 480 people), Technical Center (approximately 475 people), DOE Idaho Falls Field Office (approximately 280 people), INEL Supercomputing Center (approximately 250 people), Secured Access Facility, and the Willow Creek Building (approximately 1200 people).

Other Facilities of Interest at the INEEL Site

Over the history of the INEEL site there were several programs designed to intentionally release radioactive materials to the environment for research purposes including examination of the dispersion of materials, the levels in the environment and the effect on the environment. Several of the major programs are listed below:

SNAP Transient Program (SNAPTRAN)

Fission Product Field Release Test (FPFRT)

The Army Above Ground Radiation Testing (ARVFS) program

Controlled Environmental Radioiodine Test (CERT)

These programs were not directly considered during this preliminary assessment however, it is believed that the primary occupational exposures associated with these projects would have been to radiation and therefore personnel exposure data for those individuals involved in these programs would be incorporated in the radiation dose records database.

II. INEEL ORGANIZATION

Below is a table that gives an overview of the major contractors at the INEEL site since 1949. As will be discussed in more detail later in this report (section III) the large number of contractors along with the frequent change in contractors at many of the facilities adds complexity to the assessment of past health and safety records since each contractor varied in approach.

ICPP	CFA	TRA	TAN	Argonne	NRF	SMC
American Cyanamid (1950-1953)	American Cyanamid (1950-1953)	American Cyanamid (1950-1953)	General Electric (1950-1953)	ANL-W University of Chicago (1949-current)	Westinghouse (1953-current	Rockwell INEL (1986-1991)
Phillips Petroleum (1953-1967	Phillips Petroleum (1953-1967	Phillips Petroleum (1953-1967	Phillips Petroleum (1953-1967			Babcock and Wilcox (1991-current)
Idaho Nuclear (1967-1972)	Idaho Nuclear (1967-1972)	Idaho Nuclear (1967-1972)	Idaho Nuclear (1967-1972)			
Allied Chemical (1972-1979)	Arojet (1972-1976)	Arojet (1972-1976)	Arojet (1972-1976)			
Exxon (1979-1984)	EG&G (1976-1995)	EG&G (1976-1995)	EG&G (1976-1995)			
Westinghouse Idaho Nuclear (WINCO) (1984-1995)	Lockheed (1995-current)	Lockheed (1995-current)	Lockheed (1995-current)			
Lockheed (1995-current)						

Overall employment on the entire site has gone from approximately 1000 individuals in 1950 to a peak of approximately 13,000 in 1993. Currently the total number of workers at the INEEL site is approximately 8,000.

III. METHODOLOGY

To best summarize the exposures at the INEEL facility three basic approaches were initiated: 1) Risk Mapping of Priority Facilities and Buildings, 2) Exposures Records Review and Assessment, and 3) Development and Dissemination of a Questionnaire to former workers. The approach to each of these items is detailed within this section.

Risk Mapping

Risk Mapping is an approach that has been used extensively at industrial facilities as a tool to assist workers and/or joint health and safety committees in determining high-risk areas within their facilities. Traditionally the technique is used to identify current problem areas within a facility and to assist in developing an intervention strategy for resolving the problem areas. (ref 1,2) For this project the risk mapping approach was used to map past exposure conditions at the identified priority facilities and the priority buildings within those facilities.

In addition to using the mapping process for mapping past exposure conditions within the buildings of interest, the method was also modified to allow the field researchers to collect semi-quantitative exposure data for each identified exposure of concern. In addition, the field researchers were also tasked with collecting data regarding building/process characteristics (i.e., description of major processes, number of workers in the building of interest, years of operation, etc.).

Several steps were necessary in developing and running the risk mapping sessions. The steps were as follows:

1) The University of Massachusetts Lowell customized the risk mapping method for use in retrospective exposure assessment. Part of customizing the risk-mapping tool included the development of a "job exposure information sheet" which was used to collect job/process/exposure information for each chemical / agent identified on the risk map. (see Attachment 1) In addition, a "Building Characteristics Report Form" was developed to allow the field researchers to collect descriptive information on the building of interest (i.e., description of major processes, number of workers, years of operation, etc.). (see Attachment 2)

2) The University of Massachusetts Lowell in conjunction with the OCAW International staff developed a training guidebook for use in training the field researchers in the technique. The guidebook was constructed to include baseline information regarding the project as well as basic information regarding medical surveillance.

3) The University of Massachusetts Lowell in conjunction with the OCAW International conducted a train the trainer for the field researchers. The field researchers for this project included OCAW Local Union worker trainers and Local Union retirees. The train the trainer session was a two-day session to familiarize the field research team with the risk mapping methodology.

4) Selection of "experts" for initial risk mapping session for the INEEL complex. The University of Massachusetts Lowell coordinated with the OCAW International along with the OCAW Local Union research teams to assemble an "expert" team of former workers for the initial risk mapping session of the INEEL complex. The "experts" selected for the initial session consisted primarily of hourly workers with extensive experience at the site. Several line supervisors were also available for the "expert" session. While the group did not consist of a typical expert panel which might be assembled by researchers in order to characterize past exposures at an industrial site, the group had a vast amount of site experience and was selected to encompass a broad array of job classifications, facilities, and process buildings of interest.

5) The initial risk mapping session focused on the entire INEEL complex and was conducted to assist in determining priority areas for future, more specific, risk mapping sessions. Facility wide risk mapping results are included within Appendix A. As a product from each of these sessions, the expert group

produced a listing of the primary facilities of concern with respect to occupational exposures at the INEEL and a listing of priority buildings of greatest concern at each of the five primary facilities (CPP, TAN, TRA, CFA, and ANL). These lists, along with information obtained through review of previous research studies, were used to identify areas for future risk mapping sessions. These lists are included below.

6) Building specific risk mapping sessions were conducted for priority buildings at each of the facilities. These risk mapping sessions allowed for the collection of the aforementioned data sheets: Job Exposure Information Sheet and the Building Characteristics Report.

7) The Job Exposure Information Sheet data along with information from the Building Characteristics Reports were compiled into a database to allow for assessment of the data.

The initial risk mapping session was conducted using an INEEL territory map with the goal of identifying priority facilities within the INEEL complex. Retirees identified major facilities of concern based on past occupational exposures.

The facilities / programs that the retiree group identified as priority were as follows:

1) Test Reactor Area (TRA)
2) Chemical Processing Plant (CPP)
3) Test Area North (TAN)
4) Central Facilities Area (CFA)
5) Argonne National Laboratories – West (ANL-W)
6) Radioactive Waste Management Complex (RWMC)
7) Power Burst Facility (PBF) and Special Power Excursion Reactors (SPERT)
8) ARVFS (Army aboveground radiation tests)
9) Naval Reactor Facility (NRF)
10) Water Reactor Research Test Facility (WRRTF)
11) Auxiliary Reactor Area (ARA)
12) Idaho Falls Laboratories
13) Experimental Dairy Farm (EDF)

The group identified the first five facilities on the above list (TRA, CPP, TAN, CFA, and ANL-W) as highest priority.

The next step was to identify retirees to perform risk mapping on each of the above five facilities. From this session preliminary data regarding types of exposure which took place in each building was collected. (See Appendix A) After reviewing all of the buildings (that involved possible industrial exposures) the group was asked to develop a list of priority buildings – the buildings they believed to be the locations where chemical/agent exposures posed the highest risks to workers.

Below is a table listing the priority buildings identified within each facility. It should be noted that not all of the buildings identified, as priority buildings were risk mapped in time for inclusion within this report.

CPP	TRA	TAN	CFA	ANL-W
CPP-633 Old Waste Calciner (*)	TRA-603,604 MTR Complex (*)	TAN-607 Manufacturing and Assembly (*)	CF-665 Old Big Shop (*)	ANL-765 Fuel Conditioning Facility
CPP-601 Main Process Bldg (*)	TRA-642,3,4 ETR Complex (*)	TAN-633 Hot Cell Annex (*)	CF-621/622 New Craft Shop	ANL-766,7,8 EBR-II
CPP-602 Analytical Labs (*)	TRA-670 ATR Complex (*)	Experimental Beryllium Oxide Program (*)	CF-667 Old Weld Shop	ANL-787 Fuel Assembly and Storage
CPP-637 Process Improvement Facility	TRA-653 Machine Shop (*)	ANP / IET Program (*)	CF-649 Lead Shop (*)	ANL-752 Laboratories
CPP-666 FAST Process Bldg.	TRA-635 Material Receiving Area / Lab	TAN-604 Maintenance Bldg	CF-669 Old Hot Laundry	ANL-753 Maintenance Shop
CPP-630 Old Maintenance (*)	TRA-662 Receiving and Maint. Bldg	TAN-667 Small Machine Shop	CF-617 New Hot Laundry	ANL-782 Machine Shop
CPP-663 New Maintenance	TRA-632 Hot Cells		CF- New Big Shop	ANL-704 Fuel Manufacturing Facility
CPP-627 Remote Analytical Facility			CF-640 Old Machine Shop (*)	
CPP-684 Remote Analytical Laboratory			CF-654 Old Craft Shop (*)	
CPP-640 Decon Shop			CF-633 Labs	
CPP-603 Spent Fuel Storage			CF-664 Service Station	

*- Indicates a retiree risk mapping session was conducted for that building.

To date, a total of 20 risk mapping sessions have been conducted. These risk-mapping activities have included approximately 60-70 retirees. In each session an attempt was made to get representatives from a variety of personnel who worked in the building in question. We were successful in that we were able to include representatives from supervision, scientists/engineers, HPs, operators, and maintenance crafts.

The findings of the risk mapping sessions are summarized within section IV of this report and the database report of the data collected from the individual sessions is included in Appendix A. A breakdown of exposures by building is included within Appendix B.

Exposure Records Review and Assessment

The primary documents / data files which were identified during this preliminary assessment included:

1) "Master Update Dump" or MUD Database (1944 – 1985 External and Internal Radiation Exposure Records)
2) Radiation Dosimetry System (RDS) (1986 – current External and Internal Radiation Exposure Records)
3) Security Information Management System (SECIMS) Database (personnel and work history information)
4) Roster Database (Revision of SECIMS being developed by NIOSH)
5) Naval Reactor Facility (NRF) Dosimtery Database (1949- 1991 External and Internal Exposure Records for NRF Westinghouse employees)
6) Naval Reactor Facility (NRF) Work History Database (personnel and work history information for Westinghouse employees)
7) Off-Site Dose Reconstruction, Chemical Dose Reconstruction Draft Report, CDC
8) Off-Site Dose Reconstruction, Preliminary Assessment, SCA, Inc.
9) CDC Dose Reconstruction Database (INELCHEM Database)
10) NIOSH, Preliminary Protocol for an Epidemiological Study of Workers at the INEEL
11) Occupational Radiation Exposure History of the Idaho Field Office Operations at the INEL, J. Horan
12) Annual Health and Safety Division Reports, 1958 – 1971, USAEC Idaho Operations Office
13) ICPP Industrial Hygiene Database (HP-3000 Database, primarily records post 1985)
14) CFA System 80 Industrial Records database (1989 – current records for TAN, TRA and CFA)
15) ICPP Annual and Quarterly Production Reports, (1955 – 1971)
16) CPP Operator Process Make-Up Handbook (contained process chemistry for CPP-601 operations)
17) CDC Interview Transcripts (Personnel and Retiree interview transcripts from CDC Database)
18) Dosimetry Program Reports (IDO-12007, IDO-12070, ACI-167)
19) Work History Database (Dr. Dale Minter, MD) – Not yet located

Chemical Exposure Data

Overall, quantitative data regarding past chemical exposures appears to be limited. Some quantitative data was included within the Annual Health and Safety reports (1958 – 1971) however, this was very limited. Further efforts are underway to determine whether additional useful information regarding chemical exposures exists, including record searches at the Seattle Federal Records Center and at the Central Facilities Area (CFA) Records Storage Facility. Approximately 33,000 boxes of INEL files are stored either on-site, or at the Federal Repository. To determine whether records useful for the development of a medical screening program exist the following steps will be performed: 1) key word searches of the document control system database, 2) review of documents identified by NIOSH, and 3) review of the documents coded as relevant to epidemiological and/or health studies. Preliminary searches were performed on the existing CDC INEL database and many documents that were available at the INEEL Technical Library were obtained for this preliminary assessment. Other documents identified are archived at various repositories including the Seattle records center. A list has been identified and efforts are underway to gain access to reviewing box contents.

For purposes of the preliminary assessment, the most useful references included the ICPP Annual Production reports and Safety Analysis reports and the CDC Chemical Dose Reconstruction report and associated database. These references were beneficial primarily in determining the types of primary exposures associated with various operations. This information was used to corroborate information reported by retirees during risk mapping sessions (see Section V).

Additional quantitative data for more recent operations (1985 to current) was identified, and to some extent reviewed, however, the chemicals identified and the associated airborne levels identified may not be indicative of the chemicals and/or exposure levels of earlier time periods.

Table 1 lists chemicals of potential concern, as identified for the INEEL Dose Reconstruction Study and the NIOSH Mortality Study. (RAC for CDC, May 1998)

Radiation Exposure Data

Quantitative data regarding past radiation exposures is much more extensive and available. The document entitled "Occupational Radiation Exposure History of the Idaho Field Office Operations at the INEL" proved to be a very useful document for summarizing radiation exposure data from 1955 through 1991 at INEL. In addition, the project team has requested the Master Update Dump Database. The shortcomings of the data in both of these references appear to be the whole body count and urinalysis/fecal analysis data. While the above summary report suggests that internal doses were insignificant, past Annual Reports, risk mapping and select interviews suggest that internal exposures may be more extensive (especially at the ICPP facility).

The Master Update Dump Database includes two data sets: exp_history (exposure history) and individ_id (individual identification). The individ_id file includes 49,480 unique badge numbers while the exp_hist file includes data for the same number of badge numbers (49,480) however, includes a total of 207,663 observations. These data files include annual dose estimates from 1944 through 1985. The database includes fields for external dose, Beta dose, Neutron dose, Whole Body Count (WBC), Special Whole Body County (SWBC), Urinalysis, Thyroid, and Special Thyroid. These fields, however, only indicate the number of times per year a particular test was performed on an individual (no activity or dose data). This information could be helpful in identifying priority facilities or job classifications (with the assumption that those included in the monitoring programs were at greatest risk of internal exposure). The Individ_id file has fields for craft code and facility code however; it appears that only one entry exists for each person (no work history).

The Radiation Dosimetry Records (RDR) is similar to the MUD database but includes data from 1986 through current. The RDR database includes lifetime exposures, annual exposures, internal dose estimates, urinalysis results, fecal sampling results, and whole body counting results.

These data systems appear to be very useful in estimating individual external lifetime exposures however, the data regarding internal exposures, over the years of primary interest (1944- 1975) is insufficient to allow for assignment of a dose estimate to an individual.

INEEL has on file a group of individuals for which internal dose reconstruction was performed (approximately 300 individuals). A summary of this dose reconstruction will be requested from the site contractor.

Table 2 is a comprehensive listing of radionuclides used and/or released at the INEEL site. Primary radionuclides of concern include Uranium, Plutonium, fission products, and activation products.

Several factors, unique to the INEL facility, will make radiation dose assessment more difficult, these include:

1. Each individual site contractor designed their Health Physics program to meet the regulations as they interpreted them and to meet their site needs,
2. Individual site records more detailed than those submitted to the primary contractor (the records we have access to),

3. The regulatory requirements and the respective contractor programs changed over time (this is especially important for internal exposure information which often was only reported if in excess of an administrative or regulatory requirement),
4. Work rotation between sites (often from CFA, TRA, or TAN to CPP) to distribute dose would create a situation where a worker assigned to CFA could have received the identified exposure at CPP (more of a problem with respect to internal dose).
5. Inclusion in an internal dose-monitoring program was based upon the likelihood that they could develop internal deposition of radioactive materials. From 1958 to 1971 the number of urine and fecal samples analyzed dropped from 10,821 to 114 (Annual H&S Reports). For the most part these samples were analyzed for Gross Alpha and Gross Beta (very little isotope specific sampling).
6. Inclusion in a whole body counting program was also based upon the likelihood that an individual could develop internal deposition of radioactive materials, however, the whole body counting was performed at a centralized facility. The number of whole body counts performed per year from 1963 through 1971 appears to be fairly constant at approximately 1300 whole body counts per year (Annual H&S reports).

Criteria for identifying primary exposures

The basis for determining the primary exposures for purposes of determining the need for a medical screening program for former workers will be the data collected during the risk mapping. For external radiation exposures, lifetime doses as recorded in available database systems will be used as a determining factor.

To analyze the data collected during the risk mapping sessions conducted at the five facilities the following approach was employed:

1) Identify chemicals/agents which high level exposures were reported and develop a matrix of job title vs. chemical / agent for reported High exposures (Appendix C). It should be noted that the matrix in Appendix C includes a 'count' of how many times the job title / chemical combination was reported as High during the risk mapping sessions.
2) Using the self reported exposure level (High, Medium, Low) and the Frequency assign a "Dose Factor to each Job Title / Chemical combination. To do this we assigned numerical weights to the qualitative values (High = 10, Medium=5 and Low=1) and multiplied that value by the frequency (in hours/day) to obtain a "Dose Factor". A matrix showing "Dose Factors" for each job title / chemical combination is included within Appendix D.
3) Extract Job Titles associated with High level exposure to priority chemicals / agents (**a listing of job titles is included in the Discussion portion of this document**). Note: The "Dose Factor" method described above was used to assure that job titles with the greatest cumulative exposure to a chemical / agent were included. For example; in step 1 a job title associated with High exposures to a chemical but only exposed for 1 hour a day would be included in the analysis whereas a job title with Medium exposure to the same chemical for 8 hours a day would not be included. By incorporating the "Dose Factor" method the second individual is included since he/she would have a "Dose Factor" score of 40 (8 hours * 5).

IV. PRINCIPAL BUILDINGS/PROCESSES AND ASSOCIATED EXPOSURES

This section provides a more detailed description of the buildings and processes at five primary production facilities: ICPP, TRA, TAN, CFA and ANL-W. In addition to building and process description an overview of the primary exposures, number of employees, and job classification is also provided.

Idaho Chemical Processing Plant (ICPP)

Main Process Building (CPP-601)

Building Description

The process building, which operated from 1953 through 1994, contains 25 process cells, numerous corridors, and auxiliary cells that house the equipment and controls for separating uranium from fission products. Much of the processing equipment in the process building is located in heavily shielded cells and must be operated remotely. However, the entire plant was based on a direct-contact maintenance philosophy, i.e., maintenance was performed by direct manual contact during process shutdowns.

The Process Building operations may be divided into several individual steps including: 1) Receipt, handling, and storage of irradiated fuel elements, 2) **dissolution** of the fuel elements in various reagents, 3) **separation** of the unburned uranium from fission products and fuel element structural materials by solvent extraction, 4) salvage or recycle operations of off-specification product, or waste solutions that exceed the disposable fuel concentration limits, 5) Product packaging, storage and shipment, 6) fission product recovery, and 7) waste collection and disposal.

The first step in processing the fuel is the dissolution of the fuel in acid. The types of cladding would to some extent require changes in the dissolution process. The facility processed aluminum, zirconium, stainless steel, and graphite fuel elements (Table I). Intermittently, heel clean-outs consisting of making successive dissolutions without addition of fuel until the U-235 total grams and/or concentration is at a safe level with regard to nuclear criticality concerns. It should be noted that several criticality accidents did occur at the facility over the course of operation with the most significant occurring in October 1959. (Horan, 1993)

TABLE I: DISSOLUTION PROCESSES

Type of Fuel Element	Dissolution Process	Process Make-Up Chemicals
Navy Fuel (Zirconium Cladding)	Zirconium Dissolution	Boric Acid, HF, Nitric Acid, CrO4, Sodium bicarbonate
MTR/ATR/ETR Fuel (Aluminum cladding)	Aluminum Dissolution	Nitric Acid, Mercuric Nitrate, Ammonium Hydroxide, CrO3, Aluminum Nitrate
Stainless Steel (EBR-II)	Electrolytic	Ammonium Hydroxide, Aluminum Nitrate, Nitric Acid, Mercury, Gadolinium, Boric acid
Graphite Fuels (Rocket fuels)	Fluidized Bed-Combustion – Nitric Acid Dissolution (with Centrifuge separation)	Nitric Acid

The next step is the separation of uranium from the fission products and alloying metal by continuous liquid-liquid extraction. The process recovers greater than 99 percent of the uranium and produces a product essentially free of plutonium and with a fission product activity level that permits further processing without shielding. Three extraction cycles are normally required for adequate decontamination. Normally Tributylphosphate (TBP) dissolved in kerosene (NPH) is used as the selective solvent in first cycle extractions. Hexone (Methyl Isobutyl Ketone) is used in the second and third extraction cycles. In the initial extraction, the Uranium is preferentially extracted into the TBP-kerosene solvent, leaving the bulk of the fission products and cladding material (Aluminum, Zirconium, etc.) in the aqueous phase, which is removed as raffinate. The second and third cycle extractions are performed using hexone.

After the separation phase, the raffinate aqueous solution was sent to the Calcining facility (CPP-633) and the uranium in the solvent phase was concentrated in the Evaporator to a concentration of approximately 350 grams U-235 per liter. From here the Uranyl Nitrate solution was either shipped to Oak Ridge as product or run through the denitrating process (CPP-602) to convert the aqueous uranyl nitrate into granule uranium oxide which was subsequently shipped to Oak Ridge.

One of the original cells was modified for the recovery of intensely radioactive fission product Ba-La-140 (the Radioactive Lanthanum (RaLa) Cell) from short-cooled MTR fuel elements. This was known to be the "hottest" operation in the entire ICPP. The RaLa process operated from 1955 through 1963.

Another secondary function performed at CPP-601 was the recovery of the valuable rare gases – Krypton and Xenon.

Primary Exposures

Primary exposures reported include: CrO3 and CrO4, HF, Nitric Acid, Oxalic Acid, Sulfuric Acid, Sulfamic Acid, Aluminum Nitrate, Ferrous Ammonium Sulfate, Ammonium Hydroxide, Gadolinium Oxide, Asbestos, Cadmium Sulfate, Cadmium Nitrate, Calcium Nitrate, Kerosene (NPH), Mercuric Nitrate, Boric Acid, Hexone (Methyl Isobutyl Ketone), Sodium Hydroxide, TBP (Tributylphosphate), Uranyl Nitrate, external radiation, internal radiation, and beta radiation, TCE , Carbon Tetrachloride, and Turco 4502 "Purple Cow" (Potassium Permanganate).

Health Physics Up-grade Report (ACI-167, B.L. Rich, 1974) noted that the CPP-601 Access Corridor is "contaminated routinely to several thousand dpm/100cm^2. A specific contributing problem is the centrifuge; however, contamination potential exists from each of the cells, which are highly contaminated. The greatest contamination potential exists as a result of spills or during plant shutdown periods when the centrifuge shielding is removed. However, general levels in the corridor during normal operations require protective clothing and contamination control barriers routinely. Significant levels (greater than 10^5 dpm/100 cm^2) of Pu contamination have been identified recently in a number of cells (Cells D, Y, K, etc.)."

Description of Workforce

The workforce included the following: Operators (including operators, operator helpers, and senior operators) (25), Rad Techs (3) and Supervision (3). Maintenance workers performing work in CPP-601 (assigned to the Maintenance Building (CPP-630, CPP-663)) consisted, on average, of Instrument Techs (6), Pipefitters (3), Welders (3), Mechanics (3) and Electricians (3).

CPP Laboratories (CPP-602)

Building Description

CPP-602 houses laboratory facilities for process control, uranium accountability, and research and development. In addition the building contains a product packaging and storage area where uranyl nitrate liquid is either packaged, stored or converted to uranium oxide powder (denitration facility) for shipment (Product packaging area located in the basement of CPP-602). The Product packaging area includes the following processes: 1) Fluidized Bed Denitration, 2) Aqueous Uranyl Nitrate Packaging, 3) Granular Uranium Product Packaging, and 4) Uranium Product Storage and Shipping.

Primary Exposures

Primary exposures identified during risk mapping activities included: external radiation, internal radiation, flammable solvents, chlorinated solvents (carbon tetrachloride, TCE), beryllium, cadmium, lead, mercury, and acids (Nitric acid, Hydrofluoric Acid).

Radiation samples handled within the labs range from a few mr/hr on contact up to 200 R/hr on contact. No samples were permitted in hoods or glove boxes if the radiation level exceeded 1R/hr at 2 inches. All samples at higher levels would be handled in a laboratory cave. (ACI-167)

Exposure concerns in the Denitration facility include: Pu-238, U-234, U-235, Ru-106 along with Nitric Acid, Uranyl Nitrate, and NO2. (IN-1314, 1969)

Description of Workforce

The workforce consisted of the following: Chemists, Engineers, and Laboratory Technicians.

Waste Calcining Facility (CPP-633)

Building Description

The Waste Calcining Facility was constructed in 1963 and operated until 1981. It was designed to convert high-level radioactive liquid waste to more stable, solid, calcined granules. The Waste Calcining used a fluidized bed process to convert the high level radioactive liquid to a solid. The calcination was done by spraying the waste solution into a bed of alumina particles fluidized with air in the calciner vessel. The solid reaction products from the thermal decomposition of the waste solution build up in layers on the bed particles, while the gaseous products are swept from the vessel with the fluidizing air.

Bed temperatures of 400 degrees Celsius were required for proper decomposition and calcination reactions. The bed was maintained at this temperature through the use of heated Sodium-Potassium (NaK) flowing through a heat exchanger within the fluidized bed.

The gaseous products that are swept away from the calciner vessel with the fluidizing air are sent to the Off-Gas Decontamination System. Decontamination of the off-gas is achieved through a series of devices which include a spray quench tower, a venturi scrubber and associated cyclone-type entrainment separators, heaters, silica gel absorbers, and high efficiency filters. The off-gas is ultimately discharged to a 250-foot high stack.

Primary Exposures

Primary exposures reported during risk mapping sessions included: Asbestos, Mercury, External Radiation, Internal Radiation, NaK, Nitric Acid, Noise, and Heat.

During shutdown periods, the WCF cells present a high contamination potential with contamination levels commonly at 10^6 dpm/100cm^2 and above. The most troublesome problem was Ru-106 (beta emitter), a major contaminant which became a very difficult decontamination issue and also created problems with personnel dosimetry measurement reliability (B.L. Rich, 1974).

Description of Workforce

The workforce consisted of the following: operators (25), Rad Techs (2), and Supervision. The average maintenance workforce in the building (Maintenance workers from CPP-630, 663) included: Pipefitters (2), Instrument Techs (2), mechanics (2) and welders and electricians occasionally.

Remote Analytical Facility (CPP-627)

Building Description

CPP-627 houses the remote analytical laboratories, the multi-curie cell, a radiochemistry laboratory, and a decontamination facility. The facility was designed for remote handling of highly radioactive samples. The multi-curie cell was used for bench-scale, radioactive development work with alpha and beta/gamma sources ranging up to kilocurie levels. The multi-curie cell housed a custom process for fuel dissolution (similar to FAST except on a smaller scale). An explosion occurred in this cell in the late 1980s while working on the dissolution of Argonne fuel. The decontamination facility provides for specialized decontamination procedures to be performed on radioactively contaminate equipment; decontamination is usually accomplished by scrubbing, washing, and soaking in a variety of strong chemical reagents.

Primary Exposures

Primary exposures included: external radiation, internal radiation (Plutonium, etc.), flammable solvents, chlorinated solvents (carbon tetrachloride, TCE), beryllium, cadmium, lead, mercury, cadmium sulfate, cadmium nitrate, fluorocarbon resins, epoxy and polyurethane resins, acids (Nitric acid, Hydrofluoric Acid), and Perchloric Acid. (ICPP-SRD-1, 1974)

Samples in excess of 1 R/hr and contaminated to 10^7 dpm/100 cm^2 and above were routinely handled and decontaminated within this facility. The permanent shielding in the RAL was originally designed to reduce the exposure on the outside of the cells to approximately 1 mr/hr or less. However, an ICPP Health Physics Up-Grade Report issued in 1974 (B. Rich, 1974) concludes that "Isolation of highly contaminated equipment is impractical in the present facility; consequently, the facility is routinely contaminated. Contamination spread and personnel exposure potential is high."

Description of Workforce

The workforce consisted of the following: Operators, Engineers, Chemists, and Maintenance (from CPP-630, 663).

FAST Facility (CPP-666)

Building Description

The FAST process building replaced the E-Cell dissolvers in the Process Building CPP-601used for Zirconium Clad Fuel from Naval Nuclear Reactor Fuel. The FAST facility operated from 1984 through 1990. The FAST facility consisted of a fuel dissolution area and a fuel storage area (similar to CPP-603 fuel storage area). The FAST dissolution operation would dissolve the fuel and the dissolved product would be sent to CPP-601 for separation and recovery of the Uranium.

Primary Exposures

Primary Exposures include: HF, Boric Acid, Nitric Acid, Aluminum Nitrate, Cadmium Sulfate, Cadmium Nitrate, external radiation and internal radiation. Radiation exposures for workers in this building were lower since the facility was designed for much more remote operation, decontamination and maintenance.

A large HF spill was reported to have occurred circa 1985. (Ref: Interview with David Fry)

Description of Workforce

The workforce consisted of the following: Operators (18), Foreman (3), Supervision (3), and HP Techs (3). Maintenance worked in area on as needed basis (from CPP-630, 663) with the most frequently used crafts being pipefitters and mechanics.

New Waste Calcining Facility (CPP-659)

Building Description

The New Waste Calcining Facility was constructed in 1983 and is presently operating. The new calcining process involves spraying liquid waste onto coarse granules in an oven. After water evaporation was achieved, the dry coarse granule, calcine, was transported pneumatically to underground storage bins.

In addition to the Waste Calcining area this building included a decontamination facility.

Primary Exposures

Primary exposures reported during risk mapping sessions included: Asbestos, Mercury, External Radiation, Internal Radiation, NaK, Nitric Acid, Noise, and Heat.

Description of Workforce

The workforce consisted of the following: operators (25), HP Techs (2), Decon Techs (3), and Supervision. The average maintenance workforce in the building (Maintenance workers from CPP-630, 663) included: Pipefitters (2), Instrument Techs (2), mechanics (2) and welders and electricians occasionally.

Old Maintenance Building (CPP-630)

Building Description

The maintenance building housed several storage areas, a maintenance repair shop, electrical shop, instrument shop, weld shop, and a machine shop. The primary purpose of the facility is to provide support to the ICPP area. Routine maintenance on such items as valves, pumps, blowers, etc. is performed in this area. Welding, fabrication, and repairs involving electric arc, heliarc, and gas welding are carried out in the weld shop. This maintenance shop operated from 1952 through approximately 1978. Subsequently, maintenance operations were moved to CPP-663 (operated 1978 – present).

Maintenance crews working from this building could be assigned anywhere on the CPP site. Machinists were the only craft that spent most of their time within the maintenance building.

Primary Exposures

Primary exposures reported during risk mapping activities included: TCE, cutting oils, external radiation, internal radiation, acetone, beryllium, lead, mercury, uranium oxide, welding fumes, and zirconium.

This was the only maintenance shop at the ICPP and therefore was used for both "hot" and "cold" work. Items contaminated to several mrad/hr (B.L. Rich, 1974) were worked on routinely and/or stored in this area.

In addition, in an interview with a former machinist it was reported that Beryllium machining was performed within this building. (Ref: anonymous interview)

Description of Workforce

The workforce consisted of the following: Pipefitters (20), Mechanics (20), Instrument Techs (30-35), Electricians (30), Welders (10), Machinists (5), Painters (4), and Insulators (2).

<u>Hot Pilot Plant/Decontamination Shop/Headend Processing Plant/Rover Facility (CPP-640)</u>

Building Description

The Headend Processing Plant (HPP) contained five heavily shielded cells for new headend process for recovering uranium from spent reactor fuel. The Process Makeup Area of the HPP contains vessels for mixing process chemicals, decontamination solutions, or other chemical solutions for use in the HPP process cells.

This building served as the Headend Processing Plant/Rover Facility from 1974 through 1984. Prior to this the building was used as a Hot pilot plant and a decontamination facility (1952-1974).

The Rover Facility was involved in the dissolution of graphite fuel that reportedly resulted in extensive contamination (ref: interview with David Fry).

This facility was decontaminated in the late 1980s.

Primary Exposures

Primary exposures reported during facility wide risk mapping included: External radiation, internal radiation, caustics and solvents.

Description of Workforce

The workforce consisted of the following: Operators (8), supervision, pipefitters and electricians (as needed from CPP-630, 663).

Process Improvement Facility/ Low Bay Laboratory (CPP-637)

Building Description

CPP-637 is a chemical engineering laboratory facility where highly versatile equipment is located primarily for non-radioactive testing of plant processes and for the development of new processes. CPP-637 began operations in the early 50s and continues to operate today. While testing primarily involves non-radioactive materials, some testing was conducted with depleted or natural uranium.
This facility was used for pilot runs for the processing plant, calcining operations and the FAST facility.

This facility had a permanent maintenance crew assigned to building CPP-637.

Primary Exposures

Primary exposures include: HF, Nitric acid, sulfuric acid, hexone, TBP, kerosene, mercuric nitrate, chromium, cadmium sulfate, cadmium nitrate, TCE, external radiation and internal radiation. (ICPP-SRD-1, 1974)

Description of Workforce

The workforce consists of the following: Process Technicians, Engineers, Chemists, and Maintenance (pipefitters, mechanics, electricians, welders and instrument technicians).

Test Area North (TAN)

TAN Hot Shop (TAN-607)

Building Description

TAN-607 was the main shop for fabrication work performed at the TAN facility. From the late 1950s through 1967 the facility was used for fabrication work for the Initial Engine Test (IET), a beryllium-reflected reactor. From the early 70s through 1980 the facility was used for fabrication of the Mobile Test Assembly for the Loss of Fluids Test (LOFT) reactor. This facility was also used for the fabrication of the Experimental Beryllium Oxide Reactor (EBOR) from 1962 through 1970s. This facility was also involved in the fabrication of the Heat Transfer Reactor Experiments (I-III) from 1951 through 1961 (HTRE-III project involved a large mercury spill in 1958 during rail transfer of the reactor from the TAN facility to the IET area).

This building included several unique support facilities including: Decontamination shop, Pipe Laundry Area, Hot Cells, Hot Cell Annex (building attached to 607, TAN-633), Fuel Storage Pool, Machine Shop, Weld Shop, Maintenance Shop, and a Pipefitter shop.

TAN-607 Building was also used extensively for decontamination activities resulting from the SL-1 accident in 1961. Reportedly these decontamination activities involved high external radiation exposures along with a high potential for internal radiation exposure.

Primary Exposures

Primary exposures reported during risk mapping activities include: Beryllium, Mercury, lead, TCE, acetone, alcohol, chromium, external radiation, internal radiation, heat, methylene chloride, nitric acid, noise, silica, stoddard solvent, Turco decon solutions, and welding fumes.

Description of Workforce

At the peak operations in the early to mid 1970s approximately 160 people worked in TAN-607. This included: Hot Cell Technicians (5), Decontamination Technicians (4), pipefitters (20-50), Health Physics Technicians (5-15), machinists (20), welders (15-40), maintenance mechanics (20), materials handling (3), engineering (15), and administrative staff (15).

Initial Engine Test (IET) Area

Building Description

This program was involved in investigation of beryllium-reflected reactor performance under atmospheric conditions, nuclear excursions resulting from the immersion of the reactor in water, and from both non-destructive and destructive tests. This area was active from 1961 through 1967. In the late 1970s through late 80s decontamination work on the area was initiated.

Primary Exposures

Primary exposures reported during risk mapping activities included: Mercury, Beryllium, Lead, internal radiation, external radiation,

Description of Workforce

Primary job classifications reported during risk mapping activities included:

Test Reactor Area (TRA)

Materials Test Reactor (MTR Complex) (TRA-603, TRA-604)

Building Description

The Materials Test Reactor operated from 1952 through 1970. The Materials Test Reactor (MTR) was built to provide the capability for irradiating fuels and materials test samples and to provide neutron beam sources for basic physics research. The MTR was permanently shut down in 1970.

Primary Exposures

Primary exposures reported during risk mapping activities included: Asbestos, acids, beryllium, cadmium, carbon tetrachloride, external radiation, internal radiation, lead, mercury, nitric acid, noise, solvents, stoddard solvents, and welding fumes.

Description of Workforce

The total workforce includes approximately 140 people per day. This includes: HP Technicians (12), Maintenance Mechanics (12), Electricians (8), Instrument Maintenance (11), Reactor Instrument (7), Pipefitters (5), Welders (2), Heavy Equipment Operators (3), Process Operators (15), Reactor Operators (45), Administrative (10), Laborers (4), and Custodians (2).

Engineering Test Reactor (ETR Complex) (TRA- 642, TRA-643, TRA-644)

Building Description

The Engineering Test Reactor (ETR) operated from 1957 through 1981. The Engineering Test Reactor (ETR) was constructed in 1957, for gas-cooled reactor system testing. Both the reactor and its associated support facilities have been inactive since 1981.

Primary Exposures

Primary exposures reported during risk mapping activities included: Acetone, asbestos, beryllium, cadmium, chlorine, external radiation, heat, internal radiation, lead, mercury, nickel, nitric acid, noise, sodium metal, sodium hydroxide, stoddard solvent, sulfuric acid, TCE, Turco decon solutions, and welding fumes.

Description of Workforce

The total workforce includes approximately 140 people per day. This includes: HP Technicians (12), Maintenance Mechanics (12), Electricians (8), Instrument Maintenance (11), Reactor Instrument (7), Pipefitters (5), Welders (2), Heavy Equipment Operators (3), Process Operators (15), Reactor Operators (45), Administrative (10), Laborers (4), and Custodians (2).

Advanced Test Reactor (ATR) (TRA-670)

Building Description

The Advanced Test Reactor (ATR) has operated since 1968 and is still in operation presently. The ATR began operation at full power in 1969. It was originally constructed to continue the irradiation programs being performed by the ETR.

Primary Exposures

Primary exposures reported during risk mapping activities included: Acetic Acid, acetone, beryllium, citric acid, external radiation, internal radiation, Isopropyl alcohol, lead, nitric acid, noise, sodium hydroxide, sulfuric acid, TCE, Turco decon solutions, and welding fumes.

Description of Workforce

The total workforce includes approximately 140 people per day. This includes: HP Technicians (12), Maintenance Mechanics (12), Electricians (8), Instrument Maintenance (11), Reactor Instrument (7), Pipefitters (5), Welders (2), Heavy Equipment Operators (3), Process Operators (15), Reactor Operators (45), Administrative (10), Laborers (4), and Custodians (2).

TRA Machine Shops (TRA-653, TRA-635, TRA-662)

Building Description

TRA-653 Machine shop has operated since 1957. The facility consisted of a machining area (mills and lathes), a weld shop, a paint shop, an electrical and instrument shop and a tool room.

Primary Exposures

Primary exposures reported during risk mapping included: Acetone, asbestos, beryllium, cadmium, chromium, alcohol, external radiation, internal radiation, lead, nickel, nitric acid, noise, silica, stoddard solvent, sulfuric acid, TCE, and welding fumes.

Description of Workforce

TRA-653 had between 80 to 120 maintenance people per day working out of the building. The crafts included: Insulators (2), Maintenance mechanics (20), machinists (12-16), pipefitters (20), welders (18-42), painters (2), and laborers (15).

Central Facilities Area (CFA)

Big Shop (CFA 665, CFA 664)

Building Description

The Big Shop operated from 1949 through 1995 (CFA 665 and CFA 664). Primary activities of concern include bus fleet maintenance, bus painting, sanding, welding and brake work.

Primary Exposures

Primary exposures of concern include: asbestos (brakes), chromium, cadmium and lead (painting and sanding of buses – yellow paint was lead chromate based), carbon monoxide, noise, cleaning solvents, ethylene glycol, TCE, stoddard solvent, and welding fumes.

Description of Workforce

During peak operations the Big Shop housed approximately 250 employees including bus drivers, office staff, dispatchers, servicemen, maintenance mechanics, and parts room staff. Currently the new Transportation Building (CFA 696) houses 152 employees (17 office staff, 94 drivers, 6 dispatchers, 6 servicemen, 24 mechanics, and 3 parts room staff).

Weld Shop (CFA 667)

Building Description

CFA 667 was established as the Weld Shop in 1961. From 1952 to 1961 the welding operations were housed in building CF-649, which subsequently became the lead shop. CF-667 operated as the weld shop from 1961 to approximately 1980. Personnel from this building performed welding tasks within CF-667 as well as performing work at various buildings throughout the INEL site.

Primary Exposures

Primary exposures identified during a brief interview with a retiree included: Welding fumes, lead, and solvents. Risk mapping of this building was not completed.

In a 1962 Health and safety report nine "lead burners" were reported to have been exposed to elevated airborne concentrations of lead while working in a confined space. (IDO-) Although retirees interviewed do not recall a job classification of lead burner they believed that the nine individuals involved in this overexposure were most likely from the Weld shop (CFA-667).

Description of Workforce

The Workforce consisted of the following: Welders (10-20) and Sheet Metal Workers (3).

Lead Shop (CFA 687)

Building Description

Lead Shop (CFA-687) which operated from 1953 through 1987 housed two oil-fired bottom-pour lead pots along with accessory molds and pouring tables. This facility also had radioactive contamination concerns since many of the lead bricks being recycled were contaminated.

Primary Exposures

Primary exposures reported during risk mapping activities included: lead (fumes and particulate), external radiation, and internal radiation. Review of associated literature suggests that arsenic exposures would have occurred.

Description of Workforce

The Workforce consisted of the following: Welders (8), Laborers (2), and equipment operators (2).

Old Hot Laundry

Building Description

The laundry facility operated from the 1940s through 1981. The Laundry facility provided laundry for all of the prime contractor facilities.

Primary Exposures

Primary exposures reported during a brief interview with a retiree included: Cleaning solvents, internal radiation, and external radiation. Risk mapping was not completed on this building.

Description of Workforce

Old Machine Shop (CF-640)

Building Description

This building housed machining operations from 1955 through 1979. In 1979 the machining operations were moved to the TAN facility.

Primary Exposures

The primary exposures reported during risk mapping activities included: cutting oils, carbon tetrachloride, Stoddard Solvent, TCE, acetone, alcohol, arsenic, asbestos, cadmium, chromium, copper, lead, nickel, nitric acid, noise, and zirconium.

Contaminated materials were reportedly occasionally handled within these shops (Stroschein and Maeser (1967).

Description of Workforce

The workforce in this building consisted of approximately 16 machinists.

Old Craft Shop (CF-654)

Building Description

This building housed operations including a paint shop, carpenter shop, electrical shop, and a pipefitters shop. This building functioned as the Craft shop from approximately 1955 through 1994.

Primary Exposures

The primary exposures reported during risk mapping activities included: acetone, asbestos, carbon tetrachloride, cutting oils, epoxy, freon, hydrochloric acid, herbicides, pesticides, lead, noise, paint thinner, PCBs, and silica.

Description of Workforce

The workforce consisted of the following: painters (10), maintenance mechanics (15), electricians (12), pipefitters (15), carpenters (6), laborers (25), and insulators (1).

Argonne National Laboratories- West (ANL-W)

Experimental Breeder Reactor-II (EBR-II) (ANL-767, ANL-768, ANL-766)

Building Description

The EBR-II is an unmoderated, heterogeneous, sodium-cooled reactor which incorporated lessons learned from EBR-I. The reactor was designed as a prototype fast breeder (creating more fuel than the operation consumes) reactor to demonstrate the engineering feasibility of this concept for power generation and also to develop plutonium fuels for use in future power reactors. During its operational history the EBR-II had reactor cores consisting of both enriched uranium fuel as well as plutonium fuel.

Primary Exposures

The primary exposures reported during risk mapping sessions included: Acetone, alcohol, lead, welding fumes, chromium, sulfuric acid, sodium hydroxide, hydrazine, noise, asbestos, heat, mercury, sodium potassium, external radiation, internal radiation, and sodium metal.

Description of Workforce

The workforce as described during risk mapping participants included: Fuel handlers, Maintenance, Reactor Operators, Chemical Technicians, Chemists, Instrument Technicians, and HP Technicians.

Fuel Conditioning Facility (FCF) (ANL-765)

Building Description

The Fuel Cycle Facility, or Fuel Conditioning Facility was designed for the purpose of reprocessing spent fuel from the EBR-II reactor. The facility was designed to allow for separation of both uranium and plutonium. An enclosed passageway connects FCF and EBR-II and provides a means for transferring EBR-II spent fuel assemblies to FCF by way of an airlock large enough to accommodate either of two 18-ton interbuilding casks (IBCs). There are two washstations (located between the reactor and the hot cells) where residual external sodium is removed from spent fuel assemblies while they are still in the IBCs.

Primary Exposures

The primary exposures reported during risk mapping sessions included: Hydrochloric Acid, acetone, carbon tetrachloride, trichloroethylene, lead, cadmium, mercury, sodium, sulfuric acid, external radiation, noise, heat, asbestos, and potassium permaganate.

Description of Workforce

The workforce as described during the risk mapping participants included: Engineering Technicians, HP technicians, and Maintenance.

Other Buildings of Interest at ANL-W

Other buildings which were identified as priority buildings during preliminary facility risk mapping sessions included:

- Fuel Manufacturing Facility (ANL-704)
- Maintenance Shop (ANL-753, ANL-788)
- Machine Shop (ANL-782)
- Fuel Assembly and Storage Facility (ANL-787)
- Analytical Laboratory (ANL-752)

Field researchers will complete these building risk mapping sessions within the next few months.

V. DISCUSSION

External and Internal Radiation

The primary source of personnel external and internal exposure data is the MUD database (1950 – 1985) and the current database, the predecessor to MUD, the Radiation Dosimetry Records (RDR) database (1986 – present). The MUD database includes lifetime, cumulative, external radiation dose data for 49, 480 individuals. The MUD database will be obtained to identify those individuals exceeding established threshold for screening (i.e., 5 rem, 10 rem, 20 rem). In addition, an attempt will be made to determine whether a dosimetry file (developed by I. Aoki) can be retrieved. This dosimetry reportedly contains annual dose summaries for individuals from 1950 through 1979. According to the Horan 1993 report "Occupational Radiation Exposure History at INEL", the total collective dose for the period from 1950 through 1979 based on the Aoki database is approximately 41,695 rem (which differs slightly from the Horan data – 39,935 rem). According to an INEEL HP records contact (Marie Hill) the Aoki database tapes are retained at the INEEL.

Lifetime Exposure

Preliminary review of the Horan Occupational Radiation Dose Report (Horan, 1993) indicates that over 250 individuals from ICPP received in excess of 5 rem lifetime external dose. This report also suggests that the site with the greatest cumulative doses would be the ICPP. "The ICPP has been the major source of the highest exposures and collective dose at the INEL. This was basically due to the 1950 through 1960 plant design that provided for direct maintenance. As the reprocessing plant (CPP-601) and the original waste calcining plant (CPP-633) aged, they required more and more repairs and maintenance. It is during the shutdown periods when shielding is removed that the vast majority of occupational exposures occur." (Horan, 1993)

The highest individual lifetime dose recorded is 79.1 rem. The highest ten individual lifetime doses ranged from 61.5 to 79.1 rem (Table 3). This group included 5 pipefitters, 3 operators, 1 mechanic and 1 HP Technician. It should be noted that none of these individuals were involved in any of the 4 accidents identified above. In fact, only 2 of the individuals have annual doses of greater than 5 rem for any time during their career. During risk mapping several individuals mentioned that "during the early years" it was common practice to not wear your dosimeter when you were likely approaching the regulatory limit. A 1969 Annual Health and Safety Report (IDO-12073) includes a summary of exposures from 1960 through 1969 and concludes "the occupational crafts receiving the highest exposures were mechanics, reactor technicians, and pipe fitters". This seems consistent with the Horan report findings.

Annual Exposures

Number of workers exceeding 5 rem/yr whole body exposure (from approx. 1952 through 1992) based on site radiation records (MUD database) was 159 people, Table 4. (Horan, 1993) Independent review of the Annual Health and Safety reports, which were used as a reference for parts of the Horan report, suggests that the total number of workers exceeding 5 rem/yr may have been slightly higher (approx. 200) however, a better understanding of the data is necessary prior to making any conclusions. It should be noted that the Horan report used a combination of the MUD database records and the summary data from Annual H&S reports to summarize the INEL exposure history from 1952 through 1992 and that in at least one instance (1965 data) the MUD results were quite different (approx. 30-50% lower) than the Annual H&S report – Horan's report uses the MUD data in the summary.

It should be noted that the Horan Summary report does not include workers at all of the INEL facilities (e.g., ANL-W and NRF are not included) and therefore the overall cumulative exposures are underestimates of the exposures sustained by the entire workforce throughout the history of the facility. It should also be noted that from 1952 through 1958 site wide practice involved the issuance of weekly film badges (detection limit of 30 mrem). This policy was changed in 1958 and personnel were issued monthly or quarterly badges. This early weekly monitoring program could have resulted in underestimates of annual exposures for the years from 1952 through 1958 (ref IDO-12012).

Exposures in Excess of Radiation Protection Guidelines

The number of workers exceeding the radiation protection guidelines (varied from 15 rem/yr to 5 rem/yr) was reported as 12 individuals. These exposures were all the result of accidents:

1. July 23, 1956 – Exposure during MTR Reactor Shutdown; 21.6 rem (Included 7 other high exposures ranging from 2.5 rem to 10.6 rem)
2. October 16, 1959 – ICPP Criticality; 8 rem
3. January 1, 1961 SL-1 Reactor Accident; 9 individuals from 15 to 27 rem (overall approximately 63 individuals involved in the initial emergency response with an individual mean dose for the rescue team members of 3.83 rem)
4. December 12, 1986, Exposure during Industrial Radiography – ICPP; 7.73 rem

Internal Exposure

The Horan report and initial discussions with an individual in the Radiation Records Department suggest that exposure to internal emitters at the INEL have not been extensive. Other references, along with risk mapping data, suggest that workers at the CPP process buildings and pilot plants had a high potential for internal exposure. (ACI-167) Current plans include reviewing records of dose reconstruction work that has been done (approximately 300 individuals). An assessment of the MUD data file will also be performed to determine if there is any association between internal dose monitoring (i.e., # of urine samples/yr, # of WBCs, etc) and cumulative external dose.

A 1974 Health Physics Upgrade Report (ACI-167) indicates that "the ICPP programs do not appear to have been conducted under the true "spirit" of the ALAP philosophy for some years." The report goes on to say "conditions exist currently at the ICPP that should not be permitted under any (current or past) guidelines." "The unavoidable deteriorating attitude of plant personnel, which accompanies deteriorating plant conditions, is one of the major obstacles to the upgrading program. For example, it is hard for an operator to be concerned about 0.1 mrad/hr on a shoe when he routinely works with equipment and samples reading tens to hundreds of rad/hr with no apparent ill effects. In addition, a littered plant fosters carelessness."

The report also specifies some areas where contamination levels are excessive and need to be better controlled including:

1) "The 601 Access Corridor is contaminated routinely to several thousand dpm/100 cm^2"

2) "Significant levels (>10^5 dpm/100 cm^2) of Pu contamination have been identified recently in a number of cells (eg, Cells D, Y and K)"

3) CPP-627 "Items reading up to several rad/hr and contaminated to 10^7 dpm/100 cm^2 and above are routinely decontaminated in this area ...... contamination spread and personnel exposure potential is high"

4) CPP-630 Maintenance Shop "items contaminated to several mrad/hr are worked on routinely ... and the potential for cross contamination and spread exists"

5) WCF (CPP-633) "During shutdown periods, the WCF cells present a high contamination potential with contamination levels commonly to 10^6 dpm/100 cm^2"

6) Analytical Laboratories "High levels of contaminants are handled routinely and analyzed in a variety of facilities ranging from Remote Analytical Facilities and transuranic glove boxes to hoods and bench tops. Higher than usual (other nuclear facilities) activity is handled on an open bench tops and hoods presently. Compared to analytical facilities at some other sites, contamination spread and personnel exposure potential are significant."

The report also recommends upgrading the existing WBC to allow for lower detection limits (specifically for Plutonium). The report states that currently "measurements of the quantity of Pu in the lung at <MPBB are very difficult". The report goes on to say "It has been increasingly apparent recently that a large fraction of the routinely encountered alpha activity at the ICPP is Pu-239 and Pu-238."

Finally, selection of individuals for medical screening should be based on lifetime doses (as recorded in the MUD database or the RDR database) based on a threshold lifetime dose. Further investigation will be conducted to determine who and where internal exposures were encountered and, if possible, to determine approximate magnitudes of lifetime doses associated with internal exposures.

Beryllium

The most broad based use of Beryllium on the INEEL site identified during this preliminary exposure assessment study was the use of Beryllium as a reflector for neutrons in several reactors (MTR, ETR, ATR, EBR-II, ZPPR, ANP project, EBOR, etc.). The CDC chemical dose reconstruction report notes that in 1990 a SARA report indicates an inventory of 45,455 pounds of Beryllium Oxide. (CDC, 1998) It appears that the majority of this material exists as solid bricks used as reflectors in the various reactors around the INEEL site.

During the risk mapping sessions it was determined that Beryllium machining was performed at various buildings at the INEEL site. Based on the preliminary review performed during this assessment the following buildings were identified as having including Beryllium machining and or hand filing: TAN-607, ATR, ETR, MTR, WRRTF, and TRA-653. The job classifications associated with the reported exposures include: Machinists (Experimental Machinists (TAN) and Machinists (TRA)), Mechanics, Pipefitters, Equipment Operators, Process Operators and Reactor Operators. The exposures reported associated with the ATR, ETR, and MTR were associated with the instillation of new Beryllium during shutdown.

During a risk mapping session it was also indicated that in the TAN-607 (New Machine Shop) beryllium blocks were cut with a chop saw for purposes of disposal. In this case no protective equipment was being used.

In addition to Beryllium machining and hand filing for use within reactors at the INEEL, a review of the IH System 80 database identified building CF-689 as an area where Beryllium surveys were being performed. Further review of the survey data sheet indicated that CF-689 Room 128 had been used for "Beryllium Thermocouple Fabrication" and that the operations performed included "trim, weld, and splice, braze and solder". The decontamination work and subsequent IH surveys were performed in 1989 however, no current information is available regarding the timeframe of the Beryllium Thermocouple fabrication work.

A broad based approach to defining the group potentially exposed to beryllium is recommended since published data (Newman 1989, Kreiss 1996) demonstrate that while there are job related and exposure related elevated risks for chronic beryllium disease (CBD), individuals with low-level exposure can be affected. For this reason a two-tiered approach is recommended based on exposure groupings.

For Beryllium exposure at the facilities reviewed an attempt was made through the use of risk mapping to identify locations and job titles which were associated with Beryllium use. Since the risk mapping efforts for this preliminary assessment focused on priority areas and buildings we were not able to review all areas where beryllium was used.

Overall the results of the risk mapping performed during this preliminary assessment identified the following buildings to be associated with potential high exposure to beryllium (see Appendix B): TAN-607, TR-603 (MTR reactor), TR-642 (ETR Reactor), TR-670 (ATR Reactor), EBOR, WRRTF, and TRA-653 (Old Machine Shop). Additionally, based on the review of System 80 IH records building CF-689 (Beryllium Thermocouple Fabrication) should be included.
Overall, results of the risk mapping performed during this preliminary assessment identified the following job classifications to be associated with potential high exposure to beryllium (see Appendix C and D): Machinists (Machinists (TRA-653) and Experimental Machinists (TAN-607), mechanics, pipefitters, reactor operators, equipment operators, and process operators. Job classifications associated with operations and decontamination of CF-689 are currently unidentified.

Lead

Potential exposure to and handling of lead was performed throughout the site. The primary use of lead on the site was as shielding materials, such as lead sheeting, lead pellets, and shot used for shielding and lead pipes.

The lead shop at the CFA (CFA-687) was the only area identified where lead was melted and poured (recycling lead shielding). The lead shop housed two oil fired bottom poured lead pots along with accessory molds and pouring tables.

Additionally, one instance where lead powder was used to repair cracks in shielding at the ETR reactor.

Also, risk mapping reports indicated that handling of shielding at the reactor facilities (including hand filing, sawing, etc.) was a common practice due to frequent changes in shielding configuration for various experiments housed at the reactor facilities. The handling of lead did not usually involve the use of PPE (especially during instillation when radiation issues were not a concern).

One incident was identified associated with the construction/instillation of shielding. This incident was summarized within the 1962 and 1963 Annual Health and Safety report and is included here since airborne measurements and medical monitoring of workers involved in the incident was performed.

The 1962 Annual report indicates that a "serious lead fume exposure condition occurred in a construction area". The incident involved 9 "lead burners" working in a confined space at the bottom of a cement basin (no area or building are specified). Airborne levels of 30-85 times the TLV (0.2 mg / m^3) were identified by IH staff. Maximum blood lead level was determined to be 0.097 mg Pb / 100 cc blood; average urine was identified to be 0.416 – 0.600 mg Pb / liter of urine. Three of the men developed clinical symptoms of lead intoxication.

Half faced respirators were required after the exposure was identified. The report also noted that these workers had performed similar type of work for many years.

Overall the results of the risk mapping performed during this preliminary assessment identified the following buildings to be associated with potential high exposure to lead (see Appendix B): CF-665 (Big Shop), CF-649 (Lead Shop), CPP-630 (Old Maintenance Building), TAN-607 (Hot Shop and Hot Cells), TAN-607 (Weld Shop), TR-603 (MTR reactor), TR-642 (ETR Reactor), and TRA-653 (Old Machine Shop).

Overall, results of the risk mapping performed during this preliminary assessment identified the following job classifications to be associated with potential high exposure to lead (see Appendix C and D): Bodymen, Decon Techs, laborers, machinist, mechanics, pipefitters, process operators, and welders.
Based on the 1962 and 1963 Annual Health and Safety Reports mentioned above, Leadburners should also be included as a job classification associated with potential high exposure to lead.

Mercury

At the ICPP Mercuric Nitrate was used as a catalyst for the dissolution process (Aluminum clad fuel elements). The Mercuric Nitrate was added to the dissolution process from the process make-up floor of the CPP-601 building. Reportedly, most of the mercury remained in solution with the raffinate, which was then sent to the WCF building for calcining.

A safety analysis from 1963 estimated that 20% of the mercury introduced into the WCF with the feed might be vaporized and released to the air in the off-gas. For "commonly processed waste" this was estimated to yield concentrations of approximately 0.007 mg/m^3 (TLV for mercury vapor is currently 0.05 mg/m^3). IH data for the WCF building was not identified. (CDC)

Mercury was also used at the TAN facility in association with the ANP program. The mercury was used during the testing of the D102A turbojet engine reactor system and was used for shield augmentation (mercury was pumped into an outer primary shield tank while personnel accessed the reactor and then during testing the mercury was drained and water filled the shield area). A large mercury spill (which took place in 1958) was detected during routine health physics surveys 30 years later in 1988. A removal action was performed in 1995. (CDC CHEM) During risk mapping activities retirees recalled frequent "small" spills of less than 1 gallon of mercury along the rail tracks and within the building (TAN-607). The CDC report also references interviews with past ANP workers who estimated that total mercury used during the ANP project to be approximately 50 tons.

Overall the results of the risk mapping performed during this preliminary assessment identified the following buildings to be associated with potential high exposure to Mercury (or Mercuric Nitrate) (see Appendix B): CPP-601, CPP-633, CPP-630, CPP-602, and TAN-607.

Overall, results of the risk mapping performed during this preliminary assessment identified the following job classifications to be associated with potential high exposure to mercury (see Appendix C and D): Helpers, Decon Technicians, Hot Shop Technicians (TAN-607), and Instrument Techs.

Further investigation into the use of mercury associated with the ANP program will be conducted.

Cadmium

Cadmium exposures were reported as Cadmium Sulfate and Cadmium Nitrate within the Chemical Processing Plant. The cadmium compounds were reportedly used as "poisons" added to the process during dissolution of fuel elements. The cadmium compounds were reportedly used only for the Zirconium clad fuel elements from the Naval Nuclear Reactor program.

Originally, this process was housed within CPP-601 (the E-Cell) and was later moved to an upgraded facility known as the FAST facility (CPP-666) in 1985. The primary exposures reported were associated with the process make-up area. Based on discussions with current workers and retirees it was determined that a FAST pilot project was conducted within Building CPP-637 (Multi-curie cell) and pilot testing (cold pilot runs – no radioactive material) may have also been conducted in building CPP-627.

Some IH data is available for the FAST process building (HP-3000 Database at ICPP) which, based on a preliminary scan, appears to include primarily results of below detectable limits. A copy of this database has been requested from the contractor and will be reviewed further. Additionally, further investigation is necessary to determine whether cadmium exposures were more extensive during the pilot testing of the FAST process.

Further investigation is necessary to determine the buildings and job classifications associated with exposure to cadmium however, based on risk mapping conducted to date it appears that the following job classifications would have the greatest potential to exposure to cadmium: Operators (CPP) and Helpers (CPP).

Chromium

Chromium exposures were reported during risk mapping sessions from various manufacturing operations. At the Chemical processing plant Chromic Acid (CrO_3 and CrO_4) was used within the dissolution process. High exposures were reportedly associated primarily with operations on the Process Make-up floor of CPP-601. Additionally, based on interviews with retirees, potentially high exposures to chromic acid may have also occurred at CPP-627 and CPP-637. At the Central Facilities Area high exposures were reported within the Machine Shop (machining operations) and within the Big Shop (body men painting and sanding yellow buses – lead chromate based paint). At the TAN facility high exposures were reportedly related to machining operations.

Overall the results of the risk mapping performed during this preliminary assessment identified the following buildings to be associated with potential high exposure to Chromium compounds (see Appendix B): CF-665 (Big shop), CF-640 (Machine Shop), CPP-601, and TAN-607 (Machine Shop).

Overall, results of the risk mapping performed during this preliminary assessment identified the following job classifications to be associated with potential high exposure to Chromium compounds (see Appendix C and D): Helpers, Machinists, and bodymen.

Hydrofluoric Acid

Hydrofluoric Acid exposures were reported during risk mapping sessions for the ICPP facility. HF was used extensively in the dissolution operations (CPP-601) and the FAST dissolution operations (CPP-666). Reportedly HF was used for dissolution of Zirconium clad fuel elements. . Additionally, based on interviews with retirees, potentially high exposures to HF may have also occurred at CPP-627 and CPP-637.

Overall the results of the risk mapping performed during this preliminary assessment identified the following buildings to be associated with potential high exposure to HF (see Appendix B): CPP-601, CPP-666, CPP-627 and CPP-637.

Overall, results of the risk mapping performed during this preliminary assessment identified the following job classifications to be associated with potential high exposure to HF (see Appendix C and D): Operators, Helpers, Mechanics, Instrument Technicians, and HP Technicians (all from the CPP facility)

Nitric Acid / Nitrogen Oxide

Nitric Acid was primarily reported during risk mapping activities at the CPP facility. Nitric Acid was extensively used during dissolution of aluminum clad fuel elements. Handling of the concentrated Nitric Acid on the Process Make-up floor of the CPP-601 and CPP-633 buildings appears to have been the source of the greatest exposures. Risk mapping participants reported "constant noticeable fumes" on the process make-up floor of CPP-601.

Nitrogen Oxides, primarily nitrogen dioxide, are formed during the decomposition of nitrates in the waste solution that is calcined at the WCF building (CPP-633). Overexposures to oxides of nitrogen were reported in 1968 Annual Health and Safety Report.

Overall the results of the risk mapping performed during this preliminary assessment identified the following buildings to be associated with potential high exposure to Nitric Acid / Nitrogen Oxide (see Appendix B): CPP-601, CPP-633, CPP-627 and CPP-637, and TAN-607 (Decon Shop).

Overall, results of the risk mapping performed during this preliminary assessment identified the following job classifications to be associated with potential high exposure to nitric acid / nitrogen oxide (see

Appendix C and D): Operators, Helpers, Mechanics, Instrument Technicians, pipefitters, welders and HP Technicians (all from the CPP facility) and Decon Techs (TAN-607).

Chlorinated Solvents

Chlorinated solvents were used throughout the site. Risk mapping reports included carbon tetrachloride, Methylene Chloride, TCE and TCA. Uses reported included parts degreasing and general area decontamination (cleaning floors of reactor containment area). Within the risk mapping sessions conducted the facilities most frequently reporting potential high exposures to chlorinated solvents were the TAN facility and the TRA facility.

Overall the results of the risk mapping performed during this preliminary assessment identified the following buildings to be associated with potential high exposure to chlorinated solvents (see Appendix B): CPP-602 (Instrument Shop), CF-654 (Paint Shop), TAN-607 (Decon Shop, Pipe Laundry Area, Hot Shop 101), TRA-603 (MTR), and TRA-642 (ETR).

Overall, results of the risk mapping performed during this preliminary assessment identified the following job classifications to be associated with potential high exposure to chlorinated solvents (see Appendix C and D): Instrument Technicians (CPP), Painters (CFA), Mechanics, pipefitters, welders, laborers, electricians and Decon Techs (TAN) and laborers, mechanics, process operators, and reactor operators (TRA).

Noise

Noise exposures were reported throughout the INEL site. However, based on risk mapping sessions the process areas where highest noise levels existed were infrequently occupied. Machine shops at CFA, TRA and TAN were all reported to have high noise levels along with significant occupancy.

Overall the results of the risk mapping performed during this preliminary assessment identified the following buildings to be associated with potential high exposure to chlorinated solvents (see Appendix B): CF-640 (Machine Shop), CF-649 (Lead Shop/ Old Weld Shop), TAN-607 (Pipe Shop and Machine Shop), TRA-670 (ATR – Diesel Generator Pit), TRA-603 (MTR), TRA-642 (ETR) and TRA-653 (Machine Shop).

Overall, results of the risk mapping performed during this preliminary assessment identified the following job classifications to be associated with potential high exposure to noise (see Appendix C and D): Machinists, mechanics, process operators (TRA), pipefitters (TAN) and welders.

Asbestos

Asbestos insulation was used extensively in the 1950s when many facilities at the INEEL were initially constructed. Asbestos materials may be found in roofing, pipe and vessel insulation, building insulation, gaskets, packing, siding and other building materials.

Asbestos exposures were also noted due to work with asbestos blankets and asbestos gloves used to protect against heat while working on production equipment. In addition, mechanics working at the CFA Big Shop would have been exposed to asbestos during brake work on buses and other site vehicles.

Exposure to asbestos was reported at all of the facilities reviewed during risk mapping.

Overall, results of the risk mapping performed during this preliminary assessment identified the following job classifications to be associated with potential high exposure to asbestos (see Appendix C and D): Decon Techs, Instrument Techs, Insulators, mechanics, pipefitters, and operators.

Welding Fumes

Welding fume exposures were reported throughout the INEL site. The exposures reported during risk mapping activities include exposures within the maintenance shop buildings as well as exposures during fieldwork (i.e., maintenance work, new construction work, or system modification work).

The 1969 Annual Health and Safety report mentions a special pulmonary function testing program for 38 welders involved in the LOFT project at the TAN facility. Three individuals in this group were reported to have abnormal results. (IDO-12073)

CF-649 (Old Weld Shop), CPP-630 (Old Weld Shop), TAN-607, TRA-670 (ATR), TRA-603 (MTR), TRA-642 (ETR), and TRA-653.

Overall, results of the risk mapping performed during this preliminary assessment identified the following job classifications to be associated with potential high exposure to welding fumes (see Appendix C and D): Machinists, mechanics, pipefitters and welders.

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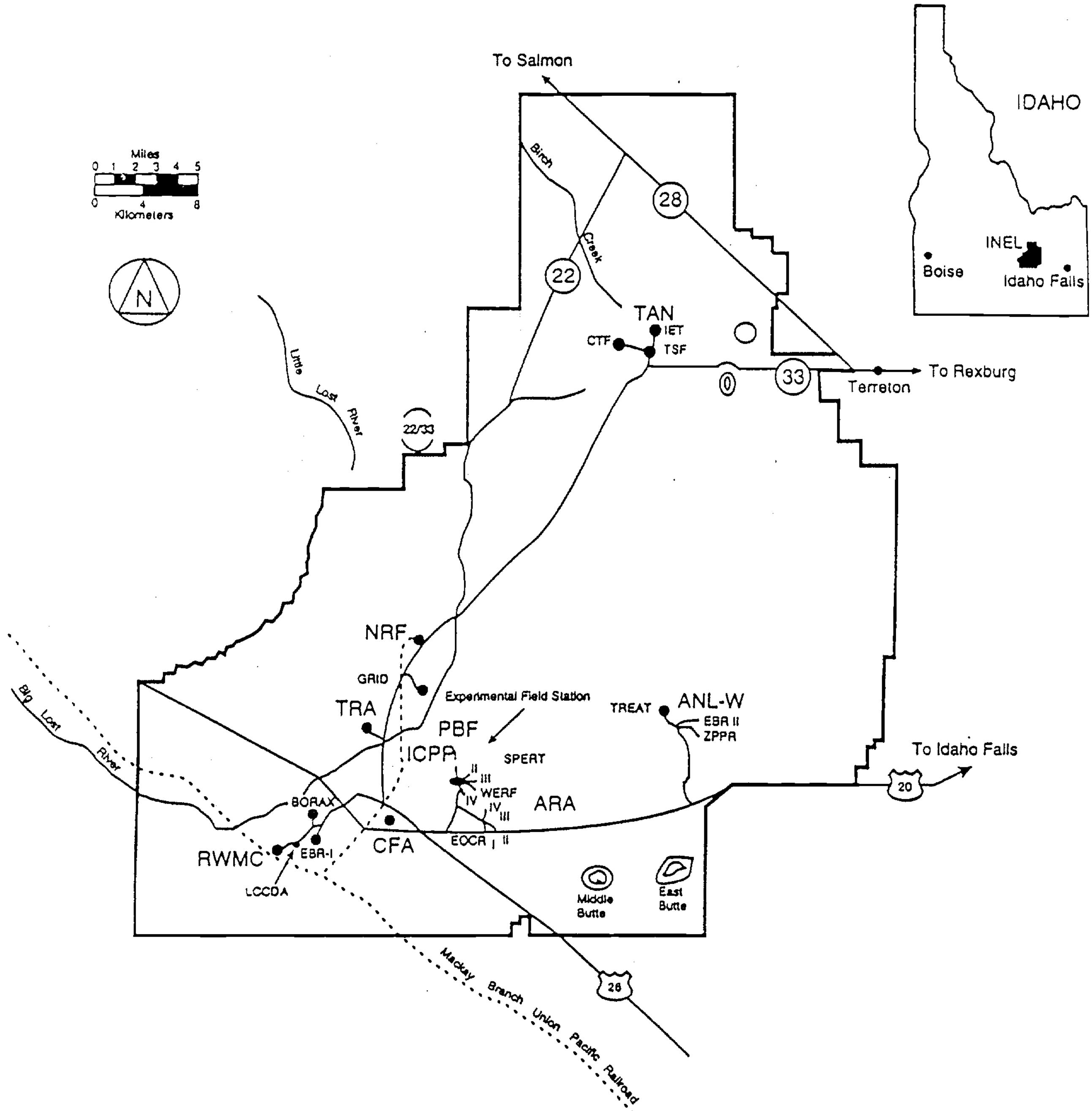
FIGURE 1: INEEL Site and Major Facilities



ANL-W	Argonne National Laboratory-West	PBF	Power Burst Facility
BORAX	Boiling Water Reactor Experiment	RWMC	Radioactive Waste Management Complex
CFA	Central Facilities Area	SPERT	Special Power Excursion Reactor Tests
CTF	Containment Test Facility	TSF	Technical Support Facilities
EBR	Experimental Breeder Reactors	TAN	Test Area North
EOCR	Experimental Organic Cooled Reactor	TRA	Test Reactor Area
ICPP	Idaho Chemical Processing Plant	TREAT	Transient Reactor Test Facility
IET	Initial Engine Test Facility	WERF	Waste Experiment Reduction Facility
LCCDA	Liquid Corrosive Chemical Disposal Area	ZPPR	Zero Power Physics Reactor
NRF	Naval Reactors Facility		

TABLE 1: CHEMICALS OF POTENTIAL CONCERN*

Chemical	Reference and location[a]
Acetone	SC&A: ICPP, TRA, ANL-W; NIOSH; ATSDR
Acetonitrile	SC&A: ICPP
Aluminum	SC&A: ICPP, TAN, CFA, ANL-W; ATSDR
Ammonia	TAER: ICPP
Ammonium hydroxide	SC&A: ICPP, ANL-W
Ammonium nitrate	TRA
Aniline	SC&A: ICPP, ANL-W
Arsenic	SC&A: ICPP, TAN, NRF, ANL-W; NIOSH; ATSDR
Asbestos	SC&A: ICPP, TRA, TAN, NRF, ANL-W; NIOSH
Barium	SC&A: ICPP, TRA
Benzene	SC&A: ICPP, TRA, TAN, NRF, ANL-W; NIOSH; ATSDR
Beryllium	TRA; NIOSH
BETZ compounds	SC&A: PBF-302 Injection Well TRA
Biphenyl	OMRE
N-Butyl Alcohol, butanol	NIOSH; SC&A: ICPP
Cadmium	SC&A: ICPP, NRF; ATSDR
Carbon disulfide	SC&A: ICPP, NRF, ANL-W; NIOSH
Carbon monoxide	SC&A: TRA
Carbon tetrachloride	SC&A: ICPP, NRF, CFA, ANL-W; NIOSH; ATSDR
Chlorine	NIOSH
Chloroform	NIOSH; ATSDR
Chromium	SC&A: ICPP, TRA, TAN, NRF, ANL-W; NIOSH; ATSDR
Cobalt	ATSDR
Copper	NIOSH; ATSDR
Cyanide	TAN, NRF
Dichloroethane	ATSDR
Diesel fuels	SARA 312 Report
Diethanolamine	SC&A: TAN
Diethylhexylphthalate	ATSDR; TRA
Diethylphthalate	ATSDR
Dionodic	PBF-302 Injection Well and PBF Evaporation Pond
Dodecane	SC&A: ICPP TRA
Endrin	SC&A
Ethanol	TAER; NIOSH
Ethylbenzene	ATSDR
Ethylene glycol	TAN
Fluoride	SC&A: NRF
Fly ash	NIOSH

* Chemical list developed by CDC; INEEL Dose Reconstruction Study, 1998

TABLE 1: CHEMICALS OF POTENTIAL CONCERN*

Chemical	Reference and location[a]
Freons	NIOSH; ICPP
Gasoline	SC&A: CFA
Gallium oxide	SC&A
HEDP, Hexaethyldiphosphate	
Hydroxy diphosphoethane	SC&A: PBF Evaporation Pond
Hexachlorobutyldiene	ATSDR
Hexane	NIOSH; ICPP
Hexone (methyl isobutyl ketone) (MIBK)	SC&A: ICPP TRA; TAER
Hydrazine	SC&A: PBF-302 Injection Well TAN
Hydroborofluoric acid	SC&A: ICPP
Hydrocarbon diluents, paraffins	SC&A: ICPP
Hydrochloric acid	SC&A: ICPP; NIOSH
Hydrofluoric acid	SC&A: ICPP, TAN, CFA, ANL-W
Hydrogen fluoride	NIOSH
Hydroxylamine sulfate	SC&A: TAN
Kerosene (AMSCO)	SC&A: ICPP, TRA
Lead	SC&A: ICPP, TRA, TAN, NRF, ANL-W; NIOSH; ATSDR
Lindane	SC&A: ICPP, NRF, TAN
Lithium	SC&A: TAN
Magnesium	NIOSH; ATSDR; ICPP
Manganese	ATSDR; ICPP
Mercury	SC&A: ICPP, TRA, TAN, CFA, ANL-W; NIOSH; ATSDR
Mercuric nitrate	SC&A: ICPP, TRA, TAN, CFA, ANL-W
Methanol	TAER; ICPP, TAN
Methoxychlor	SC&A: NRF
MethoxyDDT	SC&A: ICPP, NRF, TRA
Methylene B15	SC&A: TRA
Methylene chloride	NIOSH; ATSDR
Methyl ethyl ketone	NIOSH
Methylisobutyl ketone	ATSDR; ICPP
Monoethanolamine	TAN
Napthalenes	TAN
Nickel	TAER; ICPP
Nitrates	SC&A: ICPP; ATSDR
Nitric acid	SC&A: ICPP, NRF, ARL-W
Nitrous oxides	SC&A: ICPP; NIOSH
Oxalic acid	SC&A: ICPP, TAN
Perchloric acid	SC&A: ICPP
Phosphoric acid	SC&A: ICPP, TRA, NRF; NIOSH
PCBs	ATSDR; TRA, TAN

* Chemical list developed by CDC; INEEL Dose Reconstruction Study, 1998

TABLE 1: CHEMICALS OF POTENTIAL CONCERN*

Chemical	Reference and location[a]
Potassium hydroxide	SC&A: TRA
Potassium Permanganate	
Propanol	TAER; SC&A: ICPP, TAN
Propylene glycol	SC&A: TAN
Selenium	SC&A: ICPP, NRF; ATSDR
Silver	SC&A: ICPP
Slimicide	SC&A: PBF–302 Injection Well
Sodium	SC&A: ICPP
Sodium hydroxide	SC&A: ICPP, TRA, TAN, NRF, ANL-W; NIOSH
Sodium nitrate	SC&A: CFA
Sodium tulytriazule	SC&A: TRA, TAN
Stoddard solvent	SC&A: 500 gallons CFA, TAN; TAER
Styrene	NIOSH
Sulfuric acid	SC&A: ICPP, TRA, NRF, ANL-W
Sulfur dioxide	SC&A: ICPP, TAN, ANL-W
Terphenyls	MORE
Tetrachloroethylene	TAER
Toluene	SC&A: ICPP NRF ANL-W; NIOSH; ATSDR
Toluene di isocyanate (TDI	NIOSH
Toxaphene	NRF
Tributyl phosphate	SC&A: ICPP, TRA; ATSDR
Trichloroethane (TCA, Trichlor)	SC&A: ICPP, NRF; ATSDR
Trichloroethylene (TCE)	SC&A: ICPP, CFA, NRF, CFA, ANL-W; ATSDR
Uranium	SC&A: TAN
Vanadium	SC&A: ICPP, TAN, NRF, ANL-W; ATSDR
Xylenes	NIOSH; ATSDR; TAN
Zinc	NIOSH; ATSDR; TAN
Zirconium	SC&A: ICPP, TAN, NRF, ANL-W

[a] ANL-W = Argonne National Laboratory-West; CFA = Central Facilities Area; ICPP = Idaho Chemical Processing Plant; NRF = Naval Reactors Facility; TAN = Test Area North; TRA = Test Reactor Area.

* Chemical list developed by CDC; INEEL Dose Reconstruction Study, 1998

TABLE 2: RADIONUCLIDES OF POTENTIAL CONCERN*

Airborne Wastes

Antimony-125
Argon-41
Arsenic-76
Barium-139
Barium-140
Bromine-82
Carbon-14
Cerium-141
Cerium-144
Cesium-134
Cesium-136
Cesium-137
Cesium-138
Cesium-139
Cobalt-57
Cobalt-58
Cobalt-60
Europium-152
Europium-154
Europium-155
Hafnium-181
Iodine 129
Iodine-131
Iodine-132
Iodine-133
Iodine-134
Iodine-135
Iridium-192
Krypton-85
Krypton-85m
Krypton-87
Krypton-88
Krypton-89
Lanthanum-140
Mercury-203
Manganese-54
Manganese-56
Molybdenum-93
Molybdenum-93m
Molybdenum-103
Plutonium-238
Plutonium-239
Plutonium-240
Praseodymium-143
Promethium-147
Protactinium-234
Rhenium-188
Rubidium-88
Rubidium-89
Ruthenium-103
Ruthenium-106
Sodium-24
Strontium-89
Strontium-90
Strontium-91
Technetium-99m
Tellurium-132
Thorium-234
Tritium
Uranium-234
Uranium-238
Xenon-133
Xenon-135
Xenon-135m
Xenon-138
Yttrium-91
Yttrium-99m

Liquid Wastes

Antimony-124
Antimony-125
Barium-140
Cerium-141
Cerium-144
Cesium-134
Cesium-137
Chromium-51
Cobalt-58
Cobalt-60
Europium-153
Europium-154
Halfnium-181
Iodine-129
Iodine-131
Iron-59
Lanthanum-140
Manganese-54
Niobium-95
Ruthenium-103
Ruthenium-106
Sodium-24
Strontium-89
Strontium-90
Tantalum-182
Thorium-230
Tellurium-129m
Tritium
Yttrium-90
Yttrium-91
Zinc-65
Zirconium-95

Solid Wastes

Americium-241
Antimony-125
Barium-137m
Barium-140
Carbon-14
Cerium-141
Cerium-144
Cesium-134
Cesium-137
Chromium-51
Cobalt-57
Cobalt-58
Cobalt-60
Curium-242
Curium-244
Europium-152
Europium-154
Europium-155
Hafnium-181
Iridium-192
Iron-55
Iron-59
Iodine-129
Lanthanum-140
Manganese-54
Neptunium-237
Nickel-59
Nickel-63
Niobium-94
Niobium-95
Plutonium-238
Plutonium-239
Plutonium-240
Plutonium-241
Plutonium-242
Praseodymium-144
Radium-226
Rhodium-106
Rubidium-86
Ruthenium-106
Selenium-75
Silver-110m
Strontium-90
Tantalum-182
Technetium-99
Thorium-228
Thorium-230
Thorium-232
Tin-119m
Tin-121m
Uranium-233
Uranium-235
Uranium-238
Yttrium-90
Zinc-65
Zirconium-95

* Chemical list developed by S. Cohen & Assoc. for CDC; INEEL Dose Reconstruction Study, 1994

TABLE 3: Highest Individual Collective Doses (1951-1992)*

Identification Number	Occupation	Working Years	Collective Dose in Rem	Year*	Rem*	Employment Status
102	Mechanic	40	79.1	1967	4.3	Retired '92
353	Operator	35	69.4	1971	4.7	Retired '86
626	Pipefitter	25	69.4	1961	4.3	Continuing
424	Pipefitter	23	66.1	1959	5.4	Retired '81
5056	Pipefitter	36	64.1	1959	4.3	Retired '86
159	HP Technician	32	63.7	1973	4.6	Continuing
3056	Pipefitter	33	62.5	1961	4.3	Retired '88
475	Operator	28	62.4	1972	4.5	Retired '84
064	Pipefitter	24	62.2	1965	4.3	Retired '91
020	Operator	38	61.5	1962	9.1	Retired '92
Average		31.4	66.0		4.98	

* Highest annual dose.

* Listing from "Occupational Radiation Exposure History of Idaho Field Office Operations at the INEL", EGG-CS-11143, 1993. (J.R. Horan and J.B. Braun)

TABLE 4: INEEL Historic Radiation Exposure Distribution (Occupational Whole Body Exposure in Rem)

Cal Year	<Meas	0-1	1-2	2-3	3-4	4-5	>5	Site Pop.**	Total Mont.	Collect. Dose	Rad.Prot. Guides	> Guides
1951	*							2250	*	0		
1952	*	83						2350	*	15		
1953	*	738	34	3	2	2	1	2175	*	209		
1954	*	797	79	26	8	1	2	2525	*	388	15R	
1955	*	1336	120	76	29	10	4	3025	~2700***	839		
1956	*	964	125	61	24	9	11	3625	2810	756		
1957	*	1243	114	20	4			4550	4338	486		
1958	*	2785	260	143	47	24	29	5000	3288	1854		
1959	*	2962	257	196	33	14	5	5075	3467	2462		
1960	*	4020	220	94	51	11	1	5200	4397	2294		
1961	*	3199	346	201	138	45	19	4920	3948	2700		9
1962	*	3137	229	102	73	49	23	4755	3613	2156		
1963	*	3283	212	87	77	23		5310	3682	2156		
1964	*	2433	190	115	82	15		5900	2835	2330		
1965	*	2547	439	221	180	144	61	6025	*	3448	12 rem	
1966	*	2400	206	105	83	44		5800	2838	2412		
1967	*	2502	226	109	95	53		5825	2985	2114		
1968	*	2612	163	100	86	44	1	5850	3006	1781		
1969	*	2526	196	81	70	23		5850	2769	1723		
1970	*	2936	168	77	59	33		5755	3273	1655		
1971	*	2723	136	57	27	4		5680	2947	1180		
1972	*	2553	171	89	59	19		5875	2891	1381		
1973	*	2143	183	66	36	18	1	5975	*	1091		
1974	1885	889	133	62	20	1		5950	2990	686		
1975	1036	1363	115	51	15			3643	2580	611		
1976	2585	1704	148	75	7			4145	4519	788		
1977	1939	1385	158	94	38	6		5046	3520	929		
1978	2160	2027	161	88	18	3		5901	4457	898		
1979	2782	2318	163	61	3			6188	5327	876		
1980	2672	1724	133	43				6544	4572	593		
1981	2556	1734	36		1			6695	4327	302	5 rem	
1982	2565	1606	60	6				6653	4237	333		
1983	2780	1655	30					6391	4465	353		
1984	3172	1818	68	7				6842	5065	441		
1985	3470	1881	47	3				7186	5401	420		
1986	4689	2227	133	23		1	1	7853	7074	618		
1987	3901	1843	45	4				7586	5793	314		
1988	3829	1734	27					7998	5590	233		
1989	4144	1719	83	2				8779	5948	317		
1990	4787	1655	25	5				10295	6472	228		
Totals		79204	5639	2553	1365	596	159	220740	135524	44400		12

* Data unavailable

** 1951-1974 Total Site Population; 1975-1990 DOE-ID & Contractors

*** Compiled from AEC & Contractor Employment Graph (RESL)

* Listing from "Occupational Radiation Exposure History of Idaho Field Office Operations at the INEL", EGG-CS-11143, 1993. (J.R. Horan and J.B. Braun)

Appendix A:

Risk Mapping Results

Appendix A1: Facility Risk Mapping Results

Appendix A2: Building Risk Mapping Results (Database Report)

Appendix A1

Facility Risk Mapping Results

Preliminary Facility Risk Mapping Data -- CFA Facility

Map Dot.	Building Number	Chemical/Agent	Comments
20	617	external radiation	new laundry bldg.
20	617	internal radiation	new laundry bldg.
22	617	solvents	new laundry bldg.
3	621	metals	machining
4	621	solvents	maint bldg
2	622	welding fumes	weld shop
9	623	paint	
9	623	solvents	
9	624	paint	
9	624	solvents	
18	633	external radiation	counting lab
18	633	internal radiation	counting lab
5	640	metals	machining
5	640	lead	machining
6	654	metals	crafts shop
7	654	solvents	
14	664	sulfuric acid	
15	664	solvents	
1	667	welding fumes	weld shop
1	667	cadmium	weld shop
1	667	metals	weld shop
8	674	sulfuric acid	CPP chem research lab
25	688	asbestos	
25	689	asbestos	
25	690	asbestos	
23	696	paint	
23	696	solvents	
24	696	noise	
25	696	asbestos	brake linings
10	Big Shop	degreasers	
11	Big Shop	asbestos	
12	Big Shop	paint	
13	Big Shop	noise	
19	Old Hot Laundry	external radiation	
19	Old Hot Laundry	internal radiation	
21	Old Hot Laundry	solvents	
16	old lead shop	lead	poured lead
17	old lead shop	external radiation	contam. Lead re-milled
17	old lead shop	internal radiation	contam. Lead re-milled

Preliminary Facility Risk Mapping Data -- CPP Facility

Map Dot.	Building Number	Chemical/Agent	Comments
14	601	nitric acid	
15	601	MEK	
16	601	external radiation	
16	601	internal radiaiton	
1	602	Beryllium	1st floor of labs
1	602	Mercury	1st floor of labs
1	602	Cadmium	1st floor of labs
2	602	external radiation	1st floor of labs
2	602	internal radiaiton	1st floor of labs
3	602	carbon tetrachloride	1st floor of labs
3	602	benzene	1st floor of labs
3	602	MEK	1st floor of labs
4	602	x-ray	2nd floor of labs
6	602	asbestos	2nd floor of labs
23	603	external radiation	
24	603	welding fumes	
25	603	noise	
20	620	solvents	
21	620	metals	
22	620	caustics	
17	630	welding fumes	
18	630	noise	
19	630	cutting oils	
10	633	Kerosene	
11	633	nitric acid	
11	633	sulfuric acid	
12	633	external radiation	
12	633	internal radiaiton	
13	633	noise	
5	637	asbestos	glass blowing shop
20	637	solvents	
21	637	metals	
22	637	caustics	
7	640	external radiation	
7	640	internal radiaiton	
7	640	caustics	
7	640	solvents	
8	640	caustics	
9	640	solvents	
26	663	metals	
26	663	welding fumes	
27	663	solvents	
28	663	external radiation	
28	663	internal radiaiton	
29	663	caustics	
30	666	nitric acid	
31	666	HF	
31	666	external radiation	

Preliminary Facility Risk Mapping Data -- CPP Facility

Map Dot.	Building Number	Chemical/Agent	Comments
31	666	internal radiaiton	
32	666	cadmium sulfate	?
33	666	cadmium nitrate	?

Preliminary Facility Risk Mapping Data -- TRA Facility

Map Dot.	Building Number	Chemical/Agent	Comments
1	601	noise	
32	603	external radiation	
33	603	asbestos	
34	603	lead	shielding
17	604	noise	
35	604	acids	
35	604	caustics	
52	604	beryllium	machining
52	604	halfnium	
52	604	cadmium	
52	604	lead	
52	604	graphite	
52	604	mercury	
52	604	welding fumes	
12	605	noise	
36	605	external radiation	
36	605	internal radiation	
13	607	noise	
29	608	sulfuric acid	
29	608	sodium hydroxide	
29	608	nitric acid	
29	608	chromates	
10	609	noise	
30	609	phosphates	
30	609	sulfates	
11	610	noise	
37	610	external radiation	
37	610	internal radiation	
38	613	external radiation	
53	614	beryllium	met. Lab
53	614	halfnium	
53	614	cadmium	
53	614	lead	
53	614	graphite	
53	614	mercury	
53	614	welding fumes	
4	619	noise	
26	623	PCBs	
19	625	stoddard solvents	
19	625	degreasing solvents	
19	625	acetone	
19	625	alcohol	
16	626	noise	
25	627	benzene	cleaner; dissolve #5 and #6 oils
27	631	sulfuric acid	
47	632	external radiation	
48	632	alcohol	
48	632	acetone	

Preliminary Facility Risk Mapping Data -- TRA Facility

Map Dot.	Building Number	Chemical/Agent	Comments
5	633	noise	
51	635	beryllium	machining
51	635	halfnium	
51	635	cadmium	
51	635	lead	
51	635	graphite	
51	635	mercury	
51	635	welding fumes	
39	636	external radiation	
31	641	external radiation	
40	642	external radiation	ETR
40	642	internal radiation	ETR
41	642	NaK	ETR
41	642	lead	ETR
41	642	beryllium	ETR
41	642	cadmium	ETR
41	642	welding fumes	ETR
42	642	asbestos	piping; gloves and blankets
46	643	noise	
14	644	noise	
44	644	acids	
44	644	caustics	
45	644	asbestos	piping
65	644	external radiation	
66	644	acids	
66	644	caustics	
15	645	noise	
43	648	asbestos	Piping
2	650	noise	
49	653	stoddard solvents	
49	653	acetone	
49	653	alcohol	
49	653	methylene chloride	
50	653	beryllium	machining
50	653	halfnium	
50	653	cadmium	
50	653	lead	
50	653	graphite	
50	653	mercury	
50	653	welding fumes	
54	653	external radiation	
54	653	internal radiation	
58	654	external radiation	
59	660	external radiation	
60	661	external radiation	
60	661	internal radiation	
55	662	beryllium	machining
55	662	halfnium	

Preliminary Facility Risk Mapping Data -- TRA Facility

Map Dot.	Building Number	Chemical/Agent	Comments
55	662	cadmium	
55	662	lead	
55	662	graphite	
55	662	mercury	
55	662	welding fumes	
56	662	external radiation	
56	662	internal radiation	
57	662	paints	
57	662	paint thinners	
9	663	noise	
61	664	external radiation	
7	670	noise	
18	670	stoddard solvents	
18	670	degreasing solvents	
20	670	beryllium	handled, polished beryllium blocks for reactor
21	670	external radiation	
21	670	internal radiation	
22	670	lead	shielding
22	670	cadmium	decon
22	670	welding fumes	maint. And welders
23	670	acids	
23	670	chromates	
23	670	nitric acid	
3	672	noise	
6	674	noise	
28	677	sulfuric acid	
28	677	sodium hydroxide	
28	677	chlorine	
62	709	external radiation	
62	709	internal radiation	
63	714	Heat	
8	752	noise	
64	752	PCBs	
26	757	PCBs	
24	771	chlorine	
24	771	sulfuric acid	
24	771	chromates	
24	771	phosphates	

Preliminary Facility Risk Mapping Data -- TAN Facility

Map Dot.	Building Number	Chemical/Agent	Comments
1	603	asbestos	general area; boiler house
2	603	TCE	
2	603	acetone	
3	603	water treat chemicals	
4	603	noise	
6	604	acetone	maint, welders
6	604	stoddard solvent	maint, welders
7	604	welding fumes	
8	604	noise	weld shop sandblaster
8	604	silica	weld shop sandblaster
18	607	acids	main work area
19	607	external radiation	tAN hot cells
19	607	internal radiation	tAN hot cells
20	607	welding fumes	weld shop
20	607	mercury	machine shop
21	607	noise	
22	607	solvents	
24	609	petroleum products	mechanics workshop
24	609	stoddard solvent	mechanics workshop
12	615	acetone	LOFT fuel assembly
13	615	welding fumes	LOFT fuel assembly
25	636	noise	carpenter shop
25	636	paint/thinners	carpenter shop
5	664	oils	service station
5	664	anti-freeze	service station
9	667	acetone	new machine shop
10	667	metals	grinding machine
11	667	noise	
23	668	mild cleaners	
14	633/723	nitric acid	
14	633/723	sulfuric acid	
15	633/723	TCE	
15	633/723	Methylene Chloride	
15	633/723	stoddard solvent	
15	633/723	acetone	
15	633/723	alcohol	
17	633/723	asbestos	piping and asbestos blankets/gloves

Map Dot.	Building Number	Chemical/Agent	Comments
1	701	munitions	
31	703	sodium	contaminated sodium
31	703	NaK	contaminated sodium
31	703	external radiation	contaminated sodium
55	704	external radiation	fuel manufacture
36	706	welding fumes	
49	709	noise	
49	709	diesel fuel	
65	720	external radiation	reactor
2	742	fuels	motor fuel
58	752	external radiation	labs / Hot cells
59	752	acids and caustics	labs
60	752	laser	labs
46	753	solvents	maint bldg
47	753	noise	maint bldg
48	753	welding fumes	maint bldg
4	754	chlorine	
22	755	diesel fuel	fuel oil tank
8	757	asbestos	
3	759	high pressure gases	
3	759	motor fuels	
50	764	external radiation	susp stack
43	765	liquid argon	
51	765	external radiation	hot cells
52	765	noise	
53	765	solvents	mock-up area
54	765	mercury	IBC cooling
21	766	sodium	reactor coolant
18	767	sodium	reactor coolant
19	767	external radiation	reactor
5	768	PCBs	
7	768	sulfuric acid	
16	768	acids and caustics	
17	768	noise	air compressors
20	768	sulfuric acid	battery storage
28	769	solvents	haz mat storage
28	769	acids and caustics	haz mat storage
35	771	external radiation	
45	772	photo chemicals	
62	775	external radiation	
62	775	internal radiation	
64	775	beryllium	
61	776	external radiation	reactor
34	779	biological hazard	sewage lagoon
41	781	liquid nitrogen	
38	782	welding fumes	machine shop
39	782	solvents	machine shop
40	782	noise	machine shop

Preliminary Facility Risk Mapping Data -- ANL Facility

Map Dot.	Building Number	Chemical/Agent	Comments
63	784	external radiation	
63	784	internal radiation	
23	785	external radiation	
24	785	hydraulic fluids	
42	785	liquid argon	
44	785	compressed gas	various types
66	787	external radiation	fuel assembly
66	787	internal radiation	fuel assembly
6	788	cleaning solvents	
37	788	welding fumes	maint bldg
11	793	sodium	
11	793	NaK	
30	794	external radiation	rad storage bldg
67	795	liquid nitrogen	
33	797	external radiation	
27	798	external radiation	
56	704A	noise	compressor
26	750C	Heavy metals	industrial waste pond
57	752A	noise	diessel generator
9	757-A	acids and caustics	
15	768E	cleaning solvents	
29	783A	Fuels/Oils	motor fuel
12	785A	Water Treatment chemicals	
13	793A	Alcohol	alcohol storage
14	793B	Alcohol	
10	793-C	external radiation	rad storage bldg
68	799A	caustics	

Appendix A2

Building Risk Mapping Results (Database Report)

Risk Mapping Results
Priority Buildings from TAN, CPP, TRA and CFA

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
492	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	Acetone	2	Low	1	2	2	machinist	16
493	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	carbon tetrachloride	3	Low	1	2	2	machinist	16
494	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	alcohol	4	Low	1	2	2	machinist	16
495	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	lead	5	Low	1	2	2	machinist	16
496	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	cadmium	6	Low	1	2	2	machinist	16
499	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	copper	9	Low	1	2	2	machinist	16
500	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	zirconium	10	Low	1	2	2	machinist	16
501	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	arsenic	11	Low	1	2	2	machinist	16
502	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	lead	11	Low	1	2	2	machinist	16
503	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	"chemtool" cutting fluid	12	Low	1	8	8	machinist	16
506	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	asbestos	15	Low	1	8	8	machinist	16
504	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	Nitric Acid	13	Medium	5	2	10	machinist	16
505	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	External Radiation	14	Medium	5	8	40	machinist	16
497	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	nickel	7	High	10	8	80	machinist	16
498	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	chromium	7	High	10	8	80	machinist	16
507	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	noise	16	High	10	8	80	machinist	16
508	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	noise	16	High	10	8	80	custodian	
511	CFA	Lead Shop	649	CF-649	61	80	Entire Building	lead	1	Low	1	2	2	equipment operator	
514	CFA	Lead Shop	649	CF-649	61	80	Entire Building	lead fumes	2	Low	1	2	2	equipment operator	
515	CFA	Lead Shop	649	CF-649	61	80	Entire Building	External Radiation	3	Low	1	2	2	welder	
516	CFA	Lead Shop	649	CF-649	61	80	Entire Building	Internal Radiation	3	Low	1	2	2	welder	
517	CFA	Lead Shop	649	CF-649	61	80	Entire Building	External Radiation	4	Low	1	2	2	welder	
518	CFA	Lead Shop	649	CF-649	61	80	Entire Building	Internal Radiation	4	Low	1	2	2	welder	
521	CFA	Lead Shop	649	CF-649	61	80	Entire Building	noise	5	Low	1	2	2	equipment operator	
522	CFA	Lead Shop	649	CF-649	61	80	Entire Building	asbestos	6	Low	1	8	8	welder	
510	CFA	Lead Shop	649	CF-649	61	80	Entire Building	lead	1	Medium	5	2	10	laborer	
513	CFA	Lead Shop	649	CF-649	61	80	Entire Building	lead fumes	2	Medium	5	2	10	laborer	
520	CFA	Lead Shop	649	CF-649	61	80	Entire Building	noise	5	Medium	5	2	10	laborer	
509	CFA	Lead Shop	649	CF-649	61	80	Entire Building	lead	1	High	10	8	80	welder	
512	CFA	Lead Shop	649	CF-649	61	80	Entire Building	lead fumes	2	High	10	8	80	welder	
519	CFA	Lead Shop	649	CF-649	61	80	Entire Building	noise	5	High	10	8	80	welder	
444	CFA	Old Craft Shop	654	CF-654	55	94	Room 101	freon	2	Low	1	2	2	mechanic	15
445	CFA	Old Craft Shop	654	CF-654	55	94	Room 106	PCBs	3	Low	1	2	2	electrician	12
449	CFA	Old Craft Shop	654	CF-654	55	94	Room 110	epoxy	6	Low	1	2	2	painter	10
448	CFA	Old Craft Shop	654	CF-654	55	94	Room 110	lead	5	Low	1	8	8	painter	10
454	CFA	Old Craft Shop	654	CF-654	55	94	Entire Building	asbestos	10	Low	1	8	8	painter	10
455	CFA	Old Craft Shop	654	CF-654	55	94	Entire Building	asbestos	10	Low	1	8	8	carpenters	6
456	CFA	Old Craft Shop	654	CF-654	55	94	Entire Building	asbestos	10	Low	1	8	8	electrician	12
457	CFA	Old Craft Shop	654	CF-654	55	94	Entire Building	asbestos	10	Low	1	8	8	mechanic	15
459	CFA	Old Craft Shop	654	CF-654	55	94	Entire Building	asbestos	10	Low	1	8	8	laborer	25
460	CFA	Old Craft Shop	654	CF-654	55	94	Entire Building	asbestos	10	Low	1	8	8	supervisor	3
450	CFA	Old Craft Shop	654	CF-654	55	94	Room 111	contact cement	7	Medium	5	2	10	carpenters	6
464	CFA	Old Craft Shop	654	CF-654	55	94	Room 101	HCl	12	Medium	5	2	10	mechanic	15
465	CFA	Old Craft Shop	654	CF-654	55	94	Room 101	HCl	12	Medium	5	2	10	pipefitter	15
467	CFA	Old Craft Shop	654	CF-654	55	94	Entire Building	noise	14	Medium	5	2	10	laborer	25
468	CFA	Old Craft Shop	654	CF-654	55	94	Room 101	lead	15	Medium	5	2	10	pipefitter	15
453	CFA	Old Craft Shop	654	CF-654	55	94	Sandblast outside area	silica	9	High	10	2	20	painter	10
462	CFA	Old Craft Shop	654	CF-654	55	94	Building grounds	herbicides	11	High	10	2	20	laborer	25
463	CFA	Old Craft Shop	654	CF-654	55	94	Building grounds	pesticides	11	High	10	2	20	laborer	25
446	CFA	Old Craft Shop	654	CF-654	55	94	Room 101	cutting oils	4	Medium	5	8	40	pipefitter	15
447	CFA	Old Craft Shop	654	CF-654	55	94	Room 101	cutting oils	4	Medium	5	8	40	mechanic	15
452	CFA	Old Craft Shop	654	CF-654	55	94	Room 111	noise	8	Medium	5	8	40	laborer	25
466	CFA	Old Craft Shop	654	CF-654	55	94	Room 106	copper	13	Medium	5	8	40	electrician	12

ID	Comments
491	
492	
493	
494	
495	pouring and machining
496	everyone in shop
499	
500	
501	
502	
503	
506	wrapped service pipe; non-friable asbestos
504	scaling (cleaning agent), etching
505	Reactor from Greenland set in shop for years
497	
498	
507	
508	
511	30 days / yr for 33 years
514	lead was heated creating fumes
515	lead bricks came in contaminated sometimes
516	lead bricks came in contaminated sometimes
517	slag would float to top and normally it was contam; sent to RWMC
518	slag would float to top and normally it was contam; sent to RWMC
521	
522	used asbestos gloves
510	30 days / yr for 33 years
513	lead was heated creating fumes
520	
509	30 days / yr for 33 years
512	lead was heated creating fumes
519	
444	
445	
449	
448	lead paint
454	
455	
456	
457	
459	
460	
450	
464	used acid for cleaning
465	used acid for cleaning
467	jackhammering, etc
468	soldering copper tubing with 50:50 solder
453	
462	
463	
446	
447	
452	
466	copper wire bus bars

Risk Mapping Results
Priority Buildings from TAN, CPP, TRA and CFA

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
441	CFA	Old Craft Shop	654	CF-654	55	94	Room 110	Acetone	1	High	10	8	80	painter	10
442	CFA	Old Craft Shop	654	CF-654	55	94	Room 110	carbon tetrachloride	1	High	10	8	80	painter	10
443	CFA	Old Craft Shop	654	CF-654	55	94	Room 110	paint thinner	1	High	10	8	80	painter	10
451	CFA	Old Craft Shop	654	CF-654	55	94	Room 111	noise	8	High	10	8	80	carpenters	6
458	CFA	Old Craft Shop	654	CF-654	55	94	Entire Building	asbestos	10	High	10	8	80	pipefitter	15
461	CFA	Old Craft Shop	654	CF-654	55	94	Entire Building	asbestos	10	High	10	8	80	insulators	1
471	CFA	Old Big Shop	665	CF-665	55	96	engine overhaul shop	stoddard solvent	2	Low	1	2	2	bus drivers	
472	CFA	Old Big Shop	665	CF-665	55	96	engine overhaul shop	stoddard solvent	2	Low	1	2	2	body men	
473	CFA	Old Big Shop	665	CF-665	55	96	engine overhaul shop	stoddard solvent	2	Low	1	2	2	parts men	
480	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	Lead	9	Low	1	2	2	mechanic	60
482	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	paint stripper	9	Low	1	2	2	mechanic	60
484	CFA	Old Big Shop	665	CF-665	55	96	sandblast	silica	10	Low	1	2	2	mechanic	60
485	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	brazing flux	11	Low	1	2	2	mechanic	60
486	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	lead	12	Low	1	2	2	mechanic	60
469	CFA	Old Big Shop	665	CF-665	55	96	Degreaser	TCE	1	Medium	5	1	5	mechanic	60
477	CFA	Old Big Shop	665	CF-665	55	96	heavy shop	lifting hazard	6	Medium	5	2	10	mechanic	60
478	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	welding fumes	7	Medium	5	2	10	mechanic	60
490	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	lifting hazard	16	Medium	5	2	10	mechanic	60
487	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	asbestos	13	High	10	2	20	mechanic	60
489	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	carbon monoxide	15	High	10	2	20	mechanic	60
488	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	noise	14	Medium	5	4	20	mechanic	60
470	CFA	Old Big Shop	665	CF-665	55	96	engine overhaul shop	stoddard solvent	2	Medium	5	8	40	mechanic	60
474	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	ethylene glycol	3	Medium	5	8	40	mechanic	60
475	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	Lead	5	Medium	5	8	40	mechanic	60
476	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	sulfuric acid	5	Medium	5	8	40	mechanic	60
479	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	motor oil	8	Medium	5	8	40	mechanic	60
481	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	Lead	9	High	10	8	80	body men	4
483	CFA	Old Big Shop	665	CF-665	55	96	Entire Building	paint stripper	9	High	10	8	80	body men	4
50	CPP	Process Bldg - PM Area	601	CPP-601-4			Make-up Area	Ammonium Hydroxide	1	High	10	0.02	0.2	Operator	
56	CPP	Process Bldg - PM Area	601	CPP-601-4			PM-121	Turco 4502	5	High	10	0.1	1	Operator	
57	CPP	Process Bldg - PM Area	601	CPP-601-4			PM-121	Turco 4502	5	High	10	0.1	1	Helper	
70	CPP	Process Bldg - PM Area	601	CPP-601-4			E Cell	Internal Radiation	13	High	10	0.1	1	Operator	
71	CPP	Process Bldg - PM Area	601	CPP-601-4			E Cell	Internal Radiation	13	High	10	0.1	1	Helper	
80	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Sample Corridor	Turco 4502	4	High	10	0.1	1	Helper	
352	CPP	Process Bldg-Op&Samp	601	CPP-601-3			operating corridor	External Radiation	1	Low	1	2	2	mechanic	
353	CPP	Process Bldg-Op&Samp	601	CPP-601-3			operating corridor	External Radiation	1	Low	1	2	2	Instrument Tech	
378	CPP	Process Bldg - PM Area	601	CPP-601-4			ovens	External Radiation	7	Low	1	2	2	Operator	
379	CPP	Process Bldg - PM Area	601	CPP-601-4			ovens	Internal Radiation	7	Low	1	2	2	Operator	
66	CPP	Process Bldg - PM Area	601	CPP-601-4			E Cell	External Radiation	11	Low	1	8	8	Operator	
67	CPP	Process Bldg - PM Area	601	CPP-601-4			E Cell	External Radiation	11	Low	1	8	8	Helper	
68	CPP	Process Bldg - PM Area	601	CPP-601-4			G Cell	External Radiation	12	Low	1	8	8	Operator	
69	CPP	Process Bldg - PM Area	601	CPP-601-4			G Cell	External Radiation	12	Low	1	8	8	Helper	
351	CPP	Process Bldg-Op&Samp	601	CPP-601-3			operating corridor	External Radiation	1	Low	1	8	8	Operator	30
26	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			Corridor	External Radiation	7	Medium	5	2	10	Helper	
27	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			Corridor	External Radiation	7	Medium	5	2	10	mechanic	
28	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			Corridor	External Radiation	7	Medium	5	2	10	Instrument Tech	
29	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			Corridor	External Radiation	7	Medium	5	2	10	HP Techs	
30	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			Corridor	Internal Radiation	7	Medium	5	2	10	Operator	
31	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			Corridor	Internal Radiation	7	Medium	5	2	10	Helper	
32	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			Corridor	Internal Radiation	7	Medium	5	2	10	mechanic	
33	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			Corridor	Internal Radiation	7	Medium	5	2	10	Instrument Tech	
34	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			Corridor	Internal Radiation	7	Medium	5	2	10	HP Techs	
40	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	External Radiation	9	Medium	5	2	10	Operator	

ID	Comments
491	
441	
442	
443	
451	
458	
461	
471	
472	
473	
480	vent. Was a problem, sanding and prep. With chem. Stripper
482	vent. Was a problem, sanding and prep. With chem. Stripper
484	
485	
486	soldering joints with 50:50 solder
469	
477	battery changeout
478	
490	heavy lifting involved in doing daily duties
487	brake shoes, clutches, blowing air and grinding
489	
488	
470	
474	
475	
476	
479	
481	vent. Was a problem, sanding and prep. With chem. Stripper
483	vent. Was a problem, sanding and prep. With chem. Stripper
50	generally handled once a month
56	Used for decontamination of Cells
57	Used for decontamination of Cells
70	Occasional Pressure Build-up caused explosions
71	Occasional Pressure Build-up caused explosions
80	Used for decontamiantion
352	maint not assigned to bldg.
353	inst. Techs not assigned to bldg.
378	
379	
66	
67	
68	
69	
351	3 shifts; approx 10/shift
26	300-500 mr/hr, as high as 5 R/hr
27	300-500 mr/hr, as high as 5 R/hr
28	300-500 mr/hr, as high as 5 R/hr
29	300-500 mr/hr, as high as 5 R/hr
30	
31	
32	
33	
34	
40	

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
41	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	External Radiation	9	Medium	5	2	10	Helper	
42	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	External Radiation	9	Medium	5	2	10	mechanic	
43	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	External Radiation	9	Medium	5	2	10	HP Techs	
44	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	External Radiation	9	Medium	5	2	10	Instrument Tech	
45	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	Internal Radiation	9	Medium	5	2	10	Operator	
46	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	Internal Radiation	9	Medium	5	2	10	Helper	
47	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	Internal Radiation	9	Medium	5	2	10	mechanic	
48	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	Internal Radiation	9	Medium	5	2	10	HP Techs	
49	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	Internal Radiation	9	Medium	5	2	10	Instrument Tech	
60	CPP	Process Bldg - PM Area	601	CPP-601-4			Make-up Area	Nitric Acid	6	Medium	5	2	10	mechanic	
65	CPP	Process Bldg - PM Area	601	CPP-601-4			Make-up (Electrolytic)	Boric Acid	10	Medium	5	2	10	Helper	
360	CPP	Process Bldg-Op&Samp	601	CPP-601-3			sample corridor	External Radiation	3	Medium	5	2	10	Operator	
361	CPP	Process Bldg-Op&Samp	601	CPP-601-3			sample corridor	Internal Radiation	3	Medium	5	2	10	Operator	
362	CPP	Process Bldg - Vent	601	CPP-601-2			U-Cell	MIBK	4	Medium	5	2	10	Operator	
363	CPP	Process Bldg - Vent	601	CPP-601-2			U-Cell	MIBK	4	Medium	5	2	10	mechanic	
364	CPP	Process Bldg - Vent	601	CPP-601-2			U-Cell	MIBK	4	Medium	5	2	10	Instrument Tech	
365	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Dissolution Cells	Nitric Acid	5	Medium	5	2	10	Operator	
366	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Dissolution Cells	Nitric Acid	5	Medium	5	2	10	mechanic	
367	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Dissolution Cells	Nitric Acid	5	Medium	5	2	10	Instrument Tech	
368	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Dissolution Cells	Sulfuric Acid	5	Medium	5	2	10	Operator	
369	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Dissolution Cells	Sulfuric Acid	5	Medium	5	2	10	mechanic	
370	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Dissolution Cells	Sulfuric Acid	5	Medium	5	2	10	Instrument Tech	
371	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Dissolution Cells	HF	5	Medium	5	2	10	Operator	
372	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Dissolution Cells	HF	5	Medium	5	2	10	mechanic	
373	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Dissolution Cells	HF	5	Medium	5	2	10	Instrument Tech	
374	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Dissolution Cells	sodium hydroxide	5	Medium	5	2	10	Operator	
375	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Dissolution Cells	sodium hydroxide	5	Medium	5	2	10	mechanic	
376	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Dissolution Cells	sodium hydroxide	5	Medium	5	2	10	Instrument Tech	
35	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	HF	8	High	10	2	20	Operator	
36	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	HF	8	High	10	2	20	Helper	
37	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	HF	8	High	10	2	20	mechanic	
38	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	HF	8	High	10	2	20	HP Techs	
39	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			E Cell	HF	8	High	10	2	20	Instrument Tech	
55	CPP	Process Bldg - PM Area	601	CPP-601-4			Make-up (Electrolytic)	Gadalidium Oxide	4	High	10	2	20	Operator	
58	CPP	Process Bldg - PM Area	601	CPP-601-4			Make-up Area	Nitric Acid	6	High	10	2	20	Operator	
59	CPP	Process Bldg - PM Area	601	CPP-601-4			Make-up Area	Nitric Acid	6	High	10	2	20	Helper	
72	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Sample Corridor	Asbestos	1	High	10	2	20	Instrument Tech	
73	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Sample Corridor	Asbestos	1	High	10	2	20	mechanic	
74	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Sample Corridor	Asbestos	1	High	10	2	20	pipefitter	
75	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Sample Corridor	Asbestos	1	High	10	2	20	Operator	
77	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Sample Corridor	External Radiation	2	High	10	2	20	mechanic	
79	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Sample Corridor	External Radiation	3	High	10	2	20	mechanic	
354	CPP	Process Bldg-Op&Samp	601	CPP-601-3			cells	External Radiation	2	High	10	2	20	Operator	
355	CPP	Process Bldg-Op&Samp	601	CPP-601-3			cells	External Radiation	2	High	10	2	20	mechanic	
356	CPP	Process Bldg-Op&Samp	601	CPP-601-3			cells	External Radiation	2	High	10	2	20	Instrument Tech	
357	CPP	Process Bldg-Op&Samp	601	CPP-601-3			cells	Internal Radiation	2	High	10	2	20	Operator	
358	CPP	Process Bldg-Op&Samp	601	CPP-601-3			cells	Internal Radiation	2	High	10	2	20	mechanic	
359	CPP	Process Bldg-Op&Samp	601	CPP-601-3			cells	Internal Radiation	2	High	10	2	20	Instrument Tech	
377	CPP	Process Bldg-Op&Samp	601	CPP-601-3			operating corridor	asbestos	6	High	10	2	20	mechanic	
63	CPP	Process Bldg - PM Area	601	CPP-601-4			1st Cycle Process	Hexone	9	Medium	5	4	20	Operator	
64	CPP	Process Bldg - PM Area	601	CPP-601-4			1st Cycle Process	Hexone	9	Medium	5	4	20	Helper	
52	CPP	Process Bldg - PM Area	601	CPP-601-4			Make-up Area	HF	3	High	10	4	40	Helper	
53	CPP	Process Bldg - PM Area	601	CPP-601-4			Make-up Area	HF	3	High	10	4	40	mechanic	

ID	Comments
491	
41	
42	
43	
44	
45	
46	
47	
48	
49	
60	Noticeable fumes
65	
360	ops did decon in this area
361	ops did decon in this area
362	
363	
364	
365	
366	
367	
368	
369	
370	
371	
372	
373	
374	
375	
376	
35	
36	
37	
38	
39	
55	Costly material, made up in 640
58	Noticeable fumes
59	Noticeable fumes
72	Crawl space
73	Crawl space
74	Crawl space
75	Crawl space
77	kept dose under admin limit of 3 R
79	kept dose under admin limit of 3 R
354	dissolution cells highest; Ral.a had iodine problems
355	dissolution cells highest; Ral.a had iodine problems
356	dissolution cells highest; Ral.a had iodine problems
357	dissolution cells highest; Ral.a had iodine problems
358	dissolution cells highest; Ral.a had iodine problems
359	dissolution cells highest; Ral.a had iodine problems
377	most often encountered in piping in op corridor; also other places
63	
64	
52	
53	

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
54	CPP	Process Bldg - PM Area	601	CPP-601-4			Make-up Area	HF	3	High	10	4	40	Instrument Tech	
380	CPP	Process Bldg - PM Area	601	CPP-601-4			PM Area	cadmium Sulfate	8	Medium	5	8	40	Helper	
51	CPP	Process Bldg - PM Area	601	CPP-601-4			Make-up Area	Chromic Acid	2	High	10	8	80	Helper	
61	CPP	Process Bldg - PM Area	601	CPP-601-4			Make-up (AL-Diss.)	Mercuric Nitrate	7	High	10	8	80	Helper	
62	CPP	Process Bldg - PM Area	601	CPP-601-4			Make-up Area	Soda Ash	8	High	10	8	80	Helper	
76	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Sample Corridor	External Radiation	2	High	10	8	80	Helper	
78	CPP	Process Bldg-Op&Samp	601	CPP-601-3			Sample Corridor	External Radiation	3	High	10	8	80	Helper	
383	CPP	Old Maintenance	630	CPP-630-H			Machine Shop	Uranium	3	Medium	5	0.01	0.05	machinist	
384	CPP	Old Maintenance	630	CPP-630-H			Machine Shop	Zirconium	3	Medium	5	0.01	0.05	machinist	
381	CPP	Old Maintenance	630	CPP-630-H			Weld Shop	welding fumes	1	High	10	2	20	welder	4
382	CPP	Old Maintenance	630	CPP-630-H			Weld Shop	Acetone	2	High	10	2	20	welder	4
385	CPP	Old Maintenance	630	CPP-630-H			Machine Shop	Lead	4	High	10	2	20	machinist	
386	CPP	Old Maintenance	630	CPP-630-H			Machine Shop	cutting oils	5	Medium	5	8	40	machinist	
387	CPP	Old Maintenance	630	CPP-630-H			Instrument Shop	mercury	6	Medium	5	8	40	Instrument Tech	20
388	CPP	Old Maintenance	630	CPP-630-H			Instrument Shop	TCE	7	Medium	5	8	40	Instrument Tech	20
389	CPP	Old Calciner	633	CPP-633			Furnace Area	NaK	1	very low	0.1	2	0.2	Operator	
390	CPP	Old Calciner	633	CPP-633			Furnace Area	NaK	1	very low	0.1	2	0.2	mechanic	
391	CPP	Old Calciner	633	CPP-633			Furnace Area	NaK	1	very low	0.1	2	0.2	pipefitter	
392	CPP	Old Calciner	633	CPP-633			Furnace Area	NaK	1	very low	0.1	2	0.2	HP Techs	
393	CPP	Old Calciner	633	CPP-633			Furnace Area	heat	2	Low	1	2	2	Operator	
394	CPP	Old Calciner	633	CPP-633			Furnace Area	heat	2	Low	1	2	2	mechanic	
395	CPP	Old Calciner	633	CPP-633			Furnace Area	heat	2	Low	1	2	2	HP Techs	
396	CPP	Old Calciner	633	CPP-633			Furnace Area	heat	2	Low	1	2	2	pipefitter	
397	CPP	Old Calciner	633	CPP-633			Furnace Area	noise	2	Low	1	2	2	Operator	
398	CPP	Old Calciner	633	CPP-633			Furnace Area	noise	2	Low	1	2	2	mechanic	
399	CPP	Old Calciner	633	CPP-633			Furnace Area	noise	2	Low	1	2	2	HP Techs	
400	CPP	Old Calciner	633	CPP-633			Furnace Area	noise	2	Low	1	2	2	pipefitter	
411	CPP	Old Calciner	633	CPP-633			PM Area	Nitric Acid	6	Low	1	8	8	Operator	
414	CPP	Old Calciner	633	CPP-633			PM Area	asbestos	7	Medium	5	2	10	Operator	
415	CPP	Old Calciner	633	CPP-633			PM Area	asbestos	7	Medium	5	2	10	pipefitter	
416	CPP	Old Calciner	633	CPP-633			PM Area	asbestos	7	Medium	5	2	10	welder	
422	CPP	Old Calciner	633	CPP-633-2			cells	External Radiation	8	Medium	5	2	10	Instrument Tech	
428	CPP	Old Calciner	633	CPP-633-2			cells	Internal Radiation	8	Medium	5	2	10	Instrument Tech	
434	CPP	Old Calciner	633	CPP-633-2			cells	Nitric Acid	9	Medium	5	2	10	Instrument Tech	
435	CPP	Old Calciner	633	CPP-633			fuel storage tanks	External Radiation	10	Medium	5	2	10	pipefitter	
436	CPP	Old Calciner	633	CPP-633			fuel storage tanks	External Radiation	10	Medium	5	2	10	welder	
437	CPP	Old Calciner	633	CPP-633			fuel storage tanks	External Radiation	10	Medium	5	2	10	Operator	
438	CPP	Old Calciner	633	CPP-633			fuel storage tanks	External Radiation	10	Medium	5	2	10	HP Techs	
439	CPP	Old Calciner	633	CPP-633			off-gas cell	External Radiation	11	Medium	5	2	10	mechanic	
440	CPP	Old Calciner	633	CPP-633			off-gas cell	Internal Radiation	11	Medium	5	2	10	mechanic	
401	CPP	Old Calciner	633	CPP-633			Calciner Cell	External Radiation	3	High	10	2	20	welder	
402	CPP	Old Calciner	633	CPP-633			Calciner Cell	External Radiation	3	High	10	2	20	pipefitter	
403	CPP	Old Calciner	633	CPP-633			Calciner Cell	Internal Radiation	3	High	10	2	20	welder	
404	CPP	Old Calciner	633	CPP-633			Calciner Cell	Internal Radiation	3	High	10	2	20	pipefitter	
405	CPP	Old Calciner	633	CPP-633			Calciner Cell	Nitric Acid	4	High	10	2	20	welder	
406	CPP	Old Calciner	633	CPP-633			Calciner Cell	Nitric Acid	4	High	10	2	20	pipefitter	
407	CPP	Old Calciner	633	CPP-633			Calciner Cell	NaK	4	High	10	2	20	welder	
408	CPP	Old Calciner	633	CPP-633			Calciner Cell	NaK	4	High	10	2	20	pipefitter	
409	CPP	Old Calciner	633	CPP-633			Calciner Cell	heat	5	High	10	2	20	welder	
410	CPP	Old Calciner	633	CPP-633			Calciner Cell	heat	5	High	10	2	20	pipefitter	
412	CPP	Old Calciner	633	CPP-633			PM Area	Nitric Acid	6	High	10	2	20	pipefitter	
413	CPP	Old Calciner	633	CPP-633			PM Area	Nitric Acid	6	High	10	2	20	welder	
418	CPP	Old Calciner	633	CPP-633-2			cells	External Radiation	8	High	10	2	20	welder	

ID	Comments
491	
54	
380	used as poison for FAST pilot runs????
51	no resp. or later used a half-faced resp.
61	Material handled in powder form
62	High dust from emptying bags
76	Product Sampling
78	Raffinate Sampling
383	wet operations; rarely worked with this material
384	wet operations; rarely worked with this material
381	no resp., no contaminated parts
382	no resp.
385	cutting with recop. Saw; no resp.
386	
387	
388	
389	Fire in 1959 or 1960
390	Fire in 1959 or 1960
391	Fire in 1959 or 1960
392	Fire in 1959 or 1960
393	
394	
395	
396	
397	
398	
399	
400	
411	
414	
415	
416	
422	respirators worn
428	respirators worn
434	
435	highest rad levels in this area; tanks drained pre-maint
436	highest rad levels in this area; tanks drained pre-maint
437	highest rad levels in this area; tanks drained pre-maint
438	highest rad levels in this area; tanks drained pre-maint
439	respirators worn
440	respirators worn
401	used airlines
402	used resp
403	used airlines
404	used resp
405	
406	
407	
408	
409	
410	
412	
413	
418	respirators worn

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
419	CPP	Old Calciner	633	CPP-633-2			cells	External Radiation	8	High	10	2	20	pipefitter	
420	CPP	Old Calciner	633	CPP-633-2			cells	External Radiation	8	High	10	2	20	electrician	
424	CPP	Old Calciner	633	CPP-633-2			cells	Internal Radiation	8	High	10	2	20	welder	
425	CPP	Old Calciner	633	CPP-633-2			cells	Internal Radiation	8	High	10	2	20	pipefitter	
426	CPP	Old Calciner	633	CPP-633-2			cells	Internal Radiation	8	High	10	2	20	electrician	
430	CPP	Old Calciner	633	CPP-633-2			cells	Nitric Acid	9	High	10	2	20	welder	
431	CPP	Old Calciner	633	CPP-633-2			cells	Nitric Acid	9	High	10	2	20	pipefitter	
432	CPP	Old Calciner	633	CPP-633-2			cells	Nitric Acid	9	High	10	2	20	electrician	
433	CPP	Old Calciner	633	CPP-633-2			cells	Nitric Acid	9	High	10	2	20	HP Techs	
417	CPP	Old Calciner	633	CPP-633-2			cells	External Radiation	8	Medium	5	8	40	Operator	
423	CPP	Old Calciner	633	CPP-633-2			cells	Internal Radiation	8	Medium	5	8	40	Operator	
429	CPP	Old Calciner	633	CPP-633-2			cells	Nitric Acid	9	Medium	5	8	40	Operator	
421	CPP	Old Calciner	633	CPP-633-2			cells	External Radiation	8	High	10	8	80	HP Techs	
427	CPP	Old Calciner	633	CPP-633-2			cells	Internal Radiation	8	High	10	8	80	HP Techs	
10	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			G&H Cell	External Radiation	1	High	10	0.1	1	Instrument Tech	0
14	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			G&H Cell	Internal Radiation	2	High	10	0.1	1	Instrument Tech	0
21	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			K Cell	Hexone	5	Low	1	2	2	Operator	0
22	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			K Cell	Hexone	5	Low	1	2	2	Helper	0
19	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			G&H Cell	Nitric Acid	4	Medium	5	2	10	Operator	0
20	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			G&H Cell	Nitric Acid	4	Medium	5	2	10	Helper	0
25	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			Corridor	External Radiation	7	Medium	5	2	10	Operator	0
8	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			G&H Cell	External Radiation	1	High	10	2	20	Operator	0
9	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			G&H Cell	External Radiation	1	High	10	2	20	Helper	0
11	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			G&H Cell	External Radiation	1	High	10	2	20	HP Techs	0
12	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			G&H Cell	Internal Radiation	2	High	10	2	20	Operator	0
13	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			G&H Cell	Internal Radiation	2	High	10	2	20	Helper	0
15	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			G&H Cell	Internal Radiation	2	High	10	2	20	HP Techs	0
16	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			G&H Cell	Turco 4502	3	High	10	2	20	Operator	0
17	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			G&H Cell	Turco 4502	3	High	10	2	20	Helper	0
18	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			G&H Cell	Turco 4502	3	High	10	2	20	HP Techs	0
23	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			Centrifuge	External Radiation	6	High	10	2	20	Operator	0
24	CPP	Process Bldg - Acc. Corr.	601	CPP-601-1			Centrifuge	External Radiation	6	High	10	2	20	Helper	0
4	CPP	Analytical Lab	602	CPP-602-B			Denitrater System	External Radiation	1	Low	1	2	2	Operator	0
5	CPP	Analytical Lab	602	CPP-602-B			Denitrater System	External Radiation	1	Low	1	2	2	Helper	0
6	CPP	Analytical Lab	602	CPP-602-B			Denitrater System	Internal Radiation	1	Low	1	2	2	Operator	0
7	CPP	Analytical Lab	602	CPP-602-B			Denitrater System	Internal Radiation	1	Low	1	2	2	Helper	0
3	CPP	Analytical Lab	602	CPP-602-2	18994	22647	Instrument Shop	Lead Solder	3	Medium	5	8	40	Instrument Tech	15
1	CPP	Analytical Lab	602	CPP-602-2	18994	22647	Instrument Shop	Carbon Tetrachloride	1	High	10	8	80	Instrument Tech	15
2	CPP	Analytical Lab	602	CPP-602-2	18994	22647	Instrument Shop	Mercury	2	High	10	8	80	Instrument Tech	15
100	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Nitric Acid	5	Low	1	2	2	Decon Techs	
101	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	HF	6	Low	1	2	2	Decon Techs	
112	TAN	Manufacturing and Assembly	607	TAN-607-1			Pipe Laundry	Nitric Acid	9	Low	1	2	2	pipefitter	
113	TAN	Manufacturing and Assembly	607	TAN-607-1			Pipe Laundry	Nitric Acid	9	Low	1	2	2	mechanic	
114	TAN	Manufacturing and Assembly	607	TAN-607-1			Pipe Laundry	TCE	10	Low	1	2	2	pipefitter	
116	TAN	Manufacturing and Assembly	607	TAN-607-1			Pipe Laundry	TCE	10	Low	1	2	2	mechanic	
120	TAN	Manufacturing and Assembly	607	TAN-607-1			Pipe Laundry	noise	12	Low	1	2	2	mechanic	
121	TAN	Manufacturing and Assembly	607	TAN-607-1			Pipe Laundry	noise	12	Low	1	2	2	electrician	
122	TAN	Manufacturing and Assembly	607	TAN-607-1			Pipe Laundry	noise	12	Low	1	2	2	laborer	
129	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	External Radiation	15	Low	1	2	2	painter	
130	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	External Radiation	15	Low	1	2	2	laborer	
131	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	External Radiation	15	Low	1	2	2	mechanic	
132	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	Internal Radiation	15	Low	1	2	2	painter	
133	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	Internal Radiation	15	Low	1	2	2	laborer	

ID	Comments
491	
419	respirators worn
420	respirators worn
424	respirators worn
425	respirators worn
426	respirators worn
430	
431	
432	
433	
417	respirators worn
423	respirators worn
429	
421	respirators worn
427	respirators worn
10	Decon/Maint
14	Decon/Maint
21	
22	
19	Resp. Worn
20	Resp. Worn
25	300-500 mr/hr, as high as 5 R/hr
8	Decon/Maint
9	Decon/Maint
11	Decon/Maint
12	Decon/Maint
13	Decon/Maint
15	Decon/Maint
16	Decon
17	Decon
18	Decon
23	
24	
4	
5	
6	
7	
3	
1	Shop moved to 630 (62-80) and New Maint Bldg (80-present)
2	
100	
101	
112	cleaning aluminum
113	cleaning aluminum
114	
116	
120	
121	
122	
129	
130	
131	
132	
133	

Risk Mapping Results
Priority Buildings from TAN, CPP, TRA and CFA

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
134	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	Internal Radiation	15	Low	1	2	2	mechanic	
139	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	Acetone	18	Low	1	2	2	welder	
140	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	Acetone	18	Low	1	2	2	pipefitter	
141	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	Acetone	18	Low	1	2	2	mechanic	
142	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	Acetone	18	Low	1	2	2	electrician	
143	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	alcohol	18	Low	1	2	2	welder	
144	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	alcohol	18	Low	1	2	2	pipefitter	
145	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	alcohol	18	Low	1	2	2	mechanic	
146	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	alcohol	18	Low	1	2	2	electrician	
153	TAN	Manufacturing and Assembly	607	TAN-607-1	60	70	Highbay	Beryllium	20	Low	1	2	2	equipment operator	
161	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	silica	23	Low	1	2	2	pipefitter	
162	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	silica	23	Low	1	2	2	mechanic	
163	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	silica	23	Low	1	2	2	welder	
164	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	silica	23	Low	1	2	2	Instrument Tech	
165	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	silica	23	Low	1	2	2	electrician	
168	TAN	Manufacturing and Assembly	607	TAN-607-1			tool crib	Asbestos	25	Low	1	2	2	tool crib attendent	
185	TAN	Manufacturing and Assembly	607	TAN-607-1			machine shop	Lead	35	Low	1	2	2	Experimental Machinist	
188	TAN	Manufacturing and Assembly	607	TAN-607-1			machine shop	copper	38	Low	1	2	2	Experimental Machinist	
190	TAN	Manufacturing and Assembly	607	TAN-607-1			machine shop	Internal Radiation	40	Low	1	2	2	Experimental Machinist	
191	TAN	Manufacturing and Assembly	607	TAN-607-1			machine shop	External Radiation	40	Low	1	2	2	Experimental Machinist	
210	TAN	Manufacturing and Assembly	607	TAN-607-II			Decon Shop	Lead	11	Low	1	2	2	Decon Techs	
220	TAN	Manufacturing and Assembly	607	TAN-607-2			Respirator Shop	Internal Radiation	20	Low	1	2	2	Decon Techs	
221	TAN	Manufacturing and Assembly	607	TAN-607-2			Respirator Shop	External Radiation	20	Low	1	2	2	Decon Techs	
222	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	TCE	21	Low	1	2	2	Decon Techs	
223	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Benzene	22	Low	1	2	2	Decon Techs	
224	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	stoddard solvent	23	Low	1	2	2	Decon Techs	
225	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	stoddard solvent	23	Low	1	2	2	Hot Cell Techs	
226	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	stoddard solvent	23	Low	1	2	2	laborer	
227	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Acetone	23	Low	1	2	2	Decon Techs	
228	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Acetone	23	Low	1	2	2	Hot Cell Techs	
229	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Acetone	23	Low	1	2	2	laborer	
230	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	alcohol	23	Low	1	2	2	Decon Techs	
231	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	alcohol	23	Low	1	2	2	Hot Cell Techs	
232	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	alcohol	23	Low	1	2	2	laborer	
233	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Lead	24	Low	1	2	2	Decon Techs	
234	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Lead	24	Low	1	2	2	Hot Cell Techs	
235	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Lead	24	Low	1	2	2	laborer	
236	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Beryllium	24	Low	1	2	2	Decon Techs	
237	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Beryllium	24	Low	1	2	2	Hot Cell Techs	
238	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Beryllium	24	Low	1	2	2	laborer	
239	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	cadmium	24	Low	1	2	2	Decon Techs	
240	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	cadmium	24	Low	1	2	2	Hot Cell Techs	
241	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	cadmium	24	Low	1	2	2	laborer	
242	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	copper	24	Low	1	2	2	Decon Techs	
243	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	copper	24	Low	1	2	2	Hot Cell Techs	
244	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	copper	24	Low	1	2	2	laborer	
245	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	nickel	24	Low	1	2	2	Decon Techs	
246	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	nickel	24	Low	1	2	2	Hot Cell Techs	
247	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	nickel	24	Low	1	2	2	laborer	
248	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	silver	24	Low	1	2	2	Decon Techs	
249	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	silver	24	Low	1	2	2	Hot Cell Techs	
250	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	silver	24	Low	1	2	2	laborer	
251	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	gold	24	Low	1	2	2	Decon Techs	

ID	Comments
491	
134	
139	
140	
141	
142	
143	
144	
145	
146	
153	machined beryllium for EBOR; PPE used sometimes
161	sandblast area
162	sandblast area
163	sandblast area
164	sandblast area
165	sandblast area
168	handling fire blankets and asbestos gloves
185	
188	
190	
191	
210	decontamination of lead using acid
220	
221	
222	
223	
224	
225	
226	
227	
228	
229	
230	
231	
232	
233	most work done remotely
234	most work done remotely
235	most work done remotely
236	most work done remotely
237	most work done remotely
238	most work done remotely
239	most work done remotely
240	most work done remotely
241	most work done remotely
242	most work done remotely
243	most work done remotely
244	most work done remotely
245	most work done remotely
246	most work done remotely
247	most work done remotely
248	most work done remotely
249	most work done remotely
250	most work done remotely
251	most work done remotely

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
252	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	gold	24	Low	1	2	2	Hot Cell Techs	
253	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	gold	24	Low	1	2	2	laborer	
254	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	halfnium	24	Low	1	2	2	Decon Techs	
255	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	halfnium	24	Low	1	2	2	Hot Cell Techs	
256	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	halfnium	24	Low	1	2	2	laborer	
257	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Nitric Acid	25	Low	1	2	2	Decon Techs	
258	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Nitric Acid	25	Low	1	2	2	Hot Cell Techs	
259	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Acetic Acid	25	Low	1	2	2	Decon Techs	
260	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Acetic Acid	25	Low	1	2	2	Hot Cell Techs	
262	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	Internal Radiation	26	Low	1	2	2	Decon Techs	
296	TAN	Manufacturing and Assembly	607	TAN-607-2			Instrument Shop	mercury	43	Low	1	2	2	Instrument Tech	
299	TAN	Manufacturing and Assembly	607	TAN-607-2			electrical shop	copper	46	Low	1	2	2	electrician	
300	TAN	Manufacturing and Assembly	607	TAN-607-2			electrical shop	asbestos	47	Low	1	2	2	electrician	
301	TAN	Manufacturing and Assembly	607	TAN-607-2			electrical shop	PCBs	48	Low	1	2	2	electrician	
347	TAN	Manufacturing and Assembly	607	TAN-607-2			Storage Pool Area	External Radiation	66	Low	1	2	2	mechanic	
348	TAN	Manufacturing and Assembly	607	TAN-607-2			Storage Pool Area	External Radiation	66	Low	1	2	2	pipefitter	
349	TAN	Manufacturing and Assembly	607	TAN-607-2			Storage Pool Area	External Radiation	66	Low	1	2	2	welder	
350	TAN	Manufacturing and Assembly	607	TAN-607-2			Storage Pool Area	External Radiation	66	Low	1	2	2	technician	
117	TAN	Manufacturing and Assembly	607	TAN-607-1			Pipe Laundry	Chromium	11	Low	1	8	8	pipefitter	
118	TAN	Manufacturing and Assembly	607	TAN-607-1			Pipe Laundry	noise	12	Low	1	8	8	Decon Techs	
119	TAN	Manufacturing and Assembly	607	TAN-607-1			Pipe Laundry	noise	12	Low	1	8	8	pipefitter	
174	TAN	Manufacturing and Assembly	607	TAN-607-1			stainless steel shop	Chromium	28	Low	1	8	8	pipefitter	
269	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop 101	Internal Radiation	31	Low	1	8	8	Decon Techs	
306	TAN	Manufacturing and Assembly	607	TAN-607-2			x-ray cave	Lead	53	Low	1	8	8	quality assurance	
89	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Acetone	2	Medium	5	2	10	electrician	
94	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Methylene Chloride	3	Medium	5	2	10	electrician	
97	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Lead	4	Medium	5	2	10	mechanic	
98	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Lead	4	Medium	5	2	10	Decon Techs	
123	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	Lead	13	Medium	5	2	10	painter	
124	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	Lead	13	Medium	5	2	10	laborer	
125	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	Lead	13	Medium	5	2	10	mechanic	
126	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	chromium	14	Medium	5	2	10	painter	
127	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	Chromium	14	Medium	5	2	10	laborer	
128	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	chromium	14	Medium	5	2	10	mechanic	
147	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	Lead	19	Medium	5	2	10	welder	
148	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	Lead	19	Medium	5	2	10	pipefitter	
149	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	Lead	19	Medium	5	2	10	mechanic	
150	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	Lead	19	Medium	5	2	10	electrician	
152	TAN	Manufacturing and Assembly	607	TAN-607-1	60	70	Highbay	Beryllium	20	Medium	5	2	10	mechanic	
166	TAN	Manufacturing and Assembly	607	TAN-607-1			tool crib	Acetone	24	Medium	5	2	10	tool crib attendent	
167	TAN	Manufacturing and Assembly	607	TAN-607-1			tool crib	alcohol	24	Medium	5	2	10	tool crib attendent	
169	TAN	Manufacturing and Assembly	607	TAN-607-1			stainless steel shop	Acetone	26	Medium	5	2	10	pipefitter	
170	TAN	Manufacturing and Assembly	607	TAN-607-1			stainless steel shop	Acetone	26	Medium	5	2	10	welder	
175	TAN	Manufacturing and Assembly	607	TAN-607-1			stainless steel shop	arc flashes	29	Medium	5	2	10	welder	
176	TAN	Manufacturing and Assembly	607	TAN-607-1			stainless steel shop	arc flashes	29	Medium	5	2	10	pipefitter	
177	TAN	Manufacturing and Assembly	607	TAN-607-1			stainless steel shop	arc flashes	29	Medium	5	2	10	mechanic	
181	TAN	Manufacturing and Assembly	607	TAN-607-1	71	83	carbon steel pipe shop	welding fumes	31	Medium	5	2	10	pipefitter	
183	TAN	Manufacturing and Assembly	607	TAN-607-1	71	83	carbon steel pipe shop	noise	32	Medium	5	2	10	pipefitter	
186	TAN	Manufacturing and Assembly	607	TAN-607-1			machine shop	Beryllium	36	Medium	5	2	10	Experimental Machinist	
187	TAN	Manufacturing and Assembly	607	TAN-607-1			machine shop	nickel	37	Medium	5	2	10	Experimental Machinist	
212	TAN	Manufacturing and Assembly	607	TAN-607-11			Decon Shop	HCl	13	Medium	5	2	10	Decon Techs	
213	TAN	Manufacturing and Assembly	607	TAN-607-11			Decon Shop	HF	14	Medium	5	2	10	Decon Techs	
214	TAN	Manufacturing and Assembly	607	TAN-607-11			Decon Shop	Acetic Acid	15	Medium	5	2	10	Decon Techs	

ID	Comments
491	
252	most work done remotely
253	most work done remotely
254	most work done remotely
255	most work done remotely
256	most work done remotely
257	most work done remotely
258	most work done remotely
259	most work done remotely
260	most work done remotely
262	
296	
299	
300	
301	
347	
348	
349	
350	
117	cleaned stainless pipes
118	
119	
174	TIG welding
269	
306	shielding
89	
94	
97	
98	
123	
124	
125	
126	
127	
128	
147	shielding when building loft reactor
148	shielding when building loft reactor
149	shielding when building loft reactor
150	shielding when building loft reactor
152	machined beryllium for EBOR; PPE used sometimes
166	
167	
169	
170	
175	
176	
177	
181	Loss of Fluid Test (LOFT) Reactor Construction
183	LOFT construction (1971-1983)
186	water for exposure control; respirators used; beryllium fire late 70's (J. Lynch)
187	
212	
213	used for short period of time (approx 1 yr)
214	

Risk Mapping Results
Priority Buildings from TAN, CPP, TRA and CFA

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
217	TAN	Manufacturing and Assembly	607	TAN-607-II			Decon Shop	Asbestos	17	Medium	5	2	10	Decon Techs	
219	TAN	Manufacturing and Assembly	607	TAN-607-2			Respirator Shop	Acetone	19	Medium	5	2	10	Decon Techs	
297	TAN	Manufacturing and Assembly	607	TAN-607-2			Instrument Shop	Acetone	44	Medium	5	2	10	Instrument Tech	
298	TAN	Manufacturing and Assembly	607	TAN-607-2			Instrument Shop	freon	45	Medium	5	2	10	Instrument Tech	
302	TAN	Manufacturing and Assembly	607	TAN-607-2			x-ray area developing	x-ray chemicals	49	Medium	5	2	10	quality assurance	
303	TAN	Manufacturing and Assembly	607	TAN-607-2			x-ray area developing	silver	50	Medium	5	2	10	quality assurance	
304	TAN	Manufacturing and Assembly	607	TAN-607-2			quality assurance area	iron oxide	51	Medium	5	2	10	quality assurance	
305	TAN	Manufacturing and Assembly	607	TAN-607-2			quality assurance area	maga glow	52	Medium	5	2	10	quality assurance	
308	TAN	Manufacturing and Assembly	607	TAN-607-2			sheet metal shop	noise	55	Medium	5	2	10	sheet metal worker	
316	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot shop	Acetone	59	Medium	5	2	10	mechanic	
317	TAN	Manufacturing and Assembly	607	TAN-607-2			hot shop	Acetone	59	Medium	5	2	10	pipefitter	
318	TAN	Manufacturing and Assembly	607	TAN-607-2			hot shop	Acetone	59	Medium	5	2	10	technician	
319	TAN	Manufacturing and Assembly	607	TAN-607-2			hot shop	Acetone	59	Medium	5	2	10	laborer	
320	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Methylene Chloride	60	Medium	5	2	10	technician	
321	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Methylene Chloride	60	Medium	5	2	10	laborer	
322	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Methylene Chloride	60	Medium	5	2	10	mechanic	
323	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Methylene Chloride	60	Medium	5	2	10	welder	
324	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Methylene Chloride	60	Medium	5	2	10	pipefitter	
325	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Lead	61	Medium	5	2	10	mechanic	
326	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Lead	61	Medium	5	2	10	welder	
327	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Lead	61	Medium	5	2	10	technician	
328	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Lead	61	Medium	5	2	10	pipefitter	
81	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	TCE	1	High	10	2	20	mechanic	
82	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	TCE	1	High	10	2	20	pipefitter	
83	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	TCE	1	High	10	2	20	electrician	
84	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	TCE	1	High	10	2	20	welder	
85	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	TCE	1	High	10	2	20	laborer	
87	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Acetone	2	High	10	2	20	mechanic	
88	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Acetone	2	High	10	2	20	pipefitter	
90	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Acetone	2	High	10	2	20	laborer	
92	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Methylene Chloride	3	High	10	2	20	mechanic	
93	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Methylene Chloride	3	High	10	2	20	pipefitter	
95	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Methylene Chloride	3	High	10	2	20	laborer	
102	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	External Radiation	7	High	10	2	20	mechanic	
103	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	External Radiation	7	High	10	2	20	pipefitter	
104	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	External Radiation	7	High	10	2	20	electrician	
105	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	External Radiation	7	High	10	2	20	laborer	
107	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Heat	8	High	10	2	20	mechanic	
108	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Heat	8	High	10	2	20	pipefitter	
109	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Heat	8	High	10	2	20	laborer	
110	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Heat	8	High	10	2	20	electrician	
115	TAN	Manufacturing and Assembly	607	TAN-607-1			Pipe Laundry	TCE	10	High	10	2	20	Decon Techs	
136	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	silica	16	High	10	2	20	laborer	
151	TAN	Manufacturing and Assembly	607	TAN-607-1	60	70	Highbay	Beryllium	20	High	10	2	20	Experimental Machinist	
189	TAN	Manufacturing and Assembly	607	TAN-607-1			machine shop	Chromium	39	High	10	2	20	Experimental Machinist	
194	TAN	Manufacturing and Assembly	607	TAN-607-II		79	decon Shop	TCE	1	High	10	2	20	laborer	
198	TAN	Manufacturing and Assembly	607	TAN-607-II		79	Decon Shop	perchloroethylene	3	High	10	2	20	laborer	
200	TAN	Manufacturing and Assembly	607	TAN-607-II		79	Decon Shop	Acetone	4	High	10	2	20	laborer	
202	TAN	Manufacturing and Assembly	607	TAN-607-II		79	Decon Shop	stoddard solvent	5	High	10	2	20	laborer	
204	TAN	Manufacturing and Assembly	607	TAN-607-II			Decon Shop	sodium hydroxide	6	High	10	2	20	laborer	
206	TAN	Manufacturing and Assembly	607	TAN-607-II			Decon Shop	Nitric Acid	8	High	10	2	20	Decon Techs	
207	TAN	Manufacturing and Assembly	607	TAN-607-II			Decon Shop	turco 4518	9	High	10	2	20	Decon Techs	
208	TAN	Manufacturing and Assembly	607	TAN-607-II			Decon Shop	turco 4527	9	High	10	2	20	Decon Techs	

ID	Comments
491	
217	Decon work on items with asbestos on them
219	
297	
298	
302	
303	recovery of silver from film
304	
305	Black light NDT
308	
316	
317	
318	
319	
320	
321	
322	
323	
324	
325	used as shielding; ppe used for radiation
326	used as shielding; ppe used for radiation
327	used as shielding; ppe used for radiation
328	
81	
82	
83	
84	
85	
87	
88	
90	
92	
93	
95	
102	
103	
104	
105	
107	
108	
109	
110	
115	
136	white silica sand
151	machined beryllium for EBOR; PPE used sometimes
189	stainless steel machining
194	
198	
200	
202	
204	
206	
207	
208	

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
209	TAN	Manufacturing and Assembly	607	TAN-607-H			Decon Shop	turco solvent	10	High	10	2	20	Decon Techs	
211	TAN	Manufacturing and Assembly	607	TAN-607-H			Decon Shop	mercury	12	High	10	2	20	Decon Techs	
215	TAN	Manufacturing and Assembly	607	TAN-607-H			Decon Shop	Internal Radiation	16	High	10	2	20	Decon Techs	
216	TAN	Manufacturing and Assembly	607	TAN-607-H			Decon Shop	External Radiation	16	High	10	2	20	Decon Techs	
263	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	heat	27	High	10	2	20	Decon Techs	
264	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	heat	27	High	10	2	20	Hot Cell Techs	
266	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop 101	Methylene Chloride	29	High	10	2	20	Decon Techs	
267	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop 101	Lead	30	High	10	2	20	Decon Techs	
312	TAN	Manufacturing and Assembly	607	TAN-607-2			Weld Shop (Warm Shop)	Lead	57	High	10	2	20	laborer	
313	TAN	Manufacturing and Assembly	607	TAN-607-2			Weld Shop (Warm Shop)	Lead	57	High	10	2	20	mechanic	
314	TAN	Manufacturing and Assembly	607	TAN-607-2			Weld Shop (Warm Shop)	Lead	57	High	10	2	20	welder	
340	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Zinc Bromide	64	High	10	2	20	mechanic	
341	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Zinc Bromide	64	High	10	2	20	pipefitter	
342	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Zinc Bromide	64	High	10	2	20	laborer	
343	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop - Filter Room	Internal Radiation	65	High	10	2	20	mechanic	
344	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop - Filter Room	Internal Radiation	65	High	10	2	20	laborer	
345	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop - Filter Room	External Radiation	65	High	10	2	20	mechanic	
346	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop - Filter Room	External Radiation	65	High	10	2	20	laborer	
156	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	noise	22	Medium	5	8	40	welder	
157	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	noise	22	Medium	5	8	40	pipefitter	
158	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	noise	22	Medium	5	8	40	mechanic	
159	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	noise	22	Medium	5	8	40	electrician	
160	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	noise	22	Medium	5	8	40	Instrument Tech	
173	TAN	Manufacturing and Assembly	607	TAN-607-1			stainless steel shop	Chromium	28	Medium	5	8	40	welder	
178	TAN	Manufacturing and Assembly	607	TAN-607-1			stainless steel shop	noise	30	Medium	5	8	40	welder	
179	TAN	Manufacturing and Assembly	607	TAN-607-1			stainless steel shop	noise	30	Medium	5	8	40	pipefitter	
184	TAN	Manufacturing and Assembly	607	TAN-607-1			machine shop	cutting oils	34	Medium	5	8	40	Experimental Machinist	
268	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop 101	External Radiation	31	Medium	5	8	40	Decon Techs	
310	TAN	Manufacturing and Assembly	607	TAN-607-2			Weld Shop (Warm Shop)	welding fumes	56	Medium	5	8	40	mechanic	
311	TAN	Manufacturing and Assembly	607	TAN-607-2			Weld Shop (Warm Shop)	welding fumes	56	Medium	5	8	40	pipefitter	
86	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	TCE	1	High	10	8	80	Decon Techs	
91	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Acetone	2	High	10	8	80	Decon Techs	
96	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Methylene Chloride	3	High	10	8	80	Decon Techs	
99	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Lead	4	High	10	8	80	laborer	
106	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	External Radiation	7	High	10	8	80	Decon Techs	
111	TAN	Manufacturing and Assembly	607	TAN-607-1			Decon Shop	Heat	8	High	10	8	80	Decon Techs	
135	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	silica	16	High	10	8	80	painter	
137	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	granulated slag	17	High	10	8	80	painter	
138	TAN	Manufacturing and Assembly	607	TAN-607-1	70	83	Sandblast	granulated slag	17	High	10	8	80	laborer	
154	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	welding fumes	21	High	10	8	80	welder	
155	TAN	Manufacturing and Assembly	607	TAN-607-1			Highbay	welding fumes	21	High	10	8	80	pipefitter	
171	TAN	Manufacturing and Assembly	607	TAN-607-1			stainless steel shop	welding fumes	27	High	10	8	80	pipefitter	
172	TAN	Manufacturing and Assembly	607	TAN-607-1			stainless steel shop	welding fumes	27	High	10	8	80	welder	
180	TAN	Manufacturing and Assembly	607	TAN-607-1	71	83	carbon steel pipe shop	welding fumes	31	High	10	8	80	welder	
182	TAN	Manufacturing and Assembly	607	TAN-607-1	71	83	carbon steel pipe shop	noise	32	High	10	8	80	welder	
192	TAN	Manufacturing and Assembly	607	TAN-607-1			machine shop	noise	41	High	10	8	80	Experimental Machinist	
193	TAN	Manufacturing and Assembly	607	TAN-607-H		79	Decon Shop	TCE	1	High	10	8	80	Decon Techs	
195	TAN	Manufacturing and Assembly	607	TAN-607-H		79	Decon Shop	Methylene Chloride	2	High	10	8	80	Decon Techs	
196	TAN	Manufacturing and Assembly	607	TAN-607-H		79	Decon Shop	Methylene Chloride	2	High	10	8	80	laborer	
197	TAN	Manufacturing and Assembly	607	TAN-607-H		79	Decon Shop	perchloroethylene	3	High	10	8	80	Decon Techs	
199	TAN	Manufacturing and Assembly	607	TAN-607-H		79	Decon Shop	Acetone	4	High	10	8	80	Decon Techs	
201	TAN	Manufacturing and Assembly	607	TAN-607-H		79	Decon Shop	stoddard solvent	5	High	10	8	80	Decon Techs	
203	TAN	Manufacturing and Assembly	607	TAN-607-H			Decon Shop	sodium hydroxide	6	High	10	8	80	Decon Techs	

ID	Comments
491	
209	used in portable tank to clean electric motors, etc.
211	sump in southwest corner contam.; deconed Hg items for 1 yr
215	
216	2 of risk map participants 63R and 45R lifetime dose
263	
264	
266	used for approx. first 15 years of operation at facility
267	sawed contam. Lead bricks; used resp.
312	melting lead with rosebud (acetylene)
313	melting lead with rosebud (acetylene)
314	melting lead with rosebud (acetylene)
340	used in windows to hot shop; was filtered and cleaned; always leaked
341	
342	
343	filters contained particulate from air activity in hot shop
344	filters contained particulate from air activity in hot shop
345	filters contained particulate from air activity in hot shop
346	filters contained particulate from air activity in hot shop
156	
157	
158	
159	
160	
173	TIG welding
178	
179	
184	
268	general area (15-20mr/hr; hot spots to 7R/hr)
310	
311	
86	
91	
96	
99	
106	
111	
135	white silica sand
137	airline used
138	airline used
154	fabrication for LOFT
155	fabrication for LOFT
171	
172	
180	Loss of Fluid Test (LOFT) Reactor Construction
182	LOFT construction (1971-1983)
192	
193	
195	
196	
197	
199	
201	
203	

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
205	TAN	Manufacturing and Assembly	607	TAN-607-H			Decon Shop	turco xx	7	High	10	8	80	Decon Techs	
218	TAN	Manufacturing and Assembly	607	TAN-607-H			Decon Shop	heat	18	High	10	8	80	Decon Techs	
261	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Cell 109	External Radiation	26	High	10	8	80	Decon Techs	
265	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop 101	TCE	28	High	10	8	80	Decon Techs	
270	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop 101	heat	32	High	10	8	80	Decon Techs	
307	TAN	Manufacturing and Assembly	607	TAN-607-2			x-ray cave	External Radiation	54	High	10	8	80	quality assurance	
309	TAN	Manufacturing and Assembly	607	TAN-607-2			Weld Shop (Warm Shop)	welding fumes	56	High	10	8	80	welder	
315	TAN	Manufacturing and Assembly	607	TAN-607-2			Weld Shop (Warm Shop)	noise	58	High	10	8	80	welder	
329	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Internal Radiation	62	High	10	8	80	mechanic	
330	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Internal Radiation	62	High	10	8	80	welder	
331	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	Internal Radiation	62	High	10	8	80	pipefitter	
332	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	External Radiation	62	High	10	8	80	mechanic	
333	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	External Radiation	62	High	10	8	80	welder	
334	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	External Radiation	62	High	10	8	80	pipefitter	
335	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	heat	63	High	10	8	80	mechanic	
336	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	heat	63	High	10	8	80	welder	
337	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	heat	63	High	10	8	80	pipefitter	
338	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	heat	63	High	10	8	80	laborer	
339	TAN	Manufacturing and Assembly	607	TAN-607-2			Hot Shop	heat	63	High	10	8	80	technician	
272	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	Internal Radiation	33	Low	1	2	2	Decon Techs	
273	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	stoddard solvent	34	Low	1	2	2	Decon Techs	
274	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	alcohol	34	Low	1	2	2	Decon Techs	
275	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	TCE	34	Low	1	2	2	Decon Techs	
276	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	Acetone	34	Low	1	2	2	Decon Techs	
277	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	Methylene Chloride	34	Low	1	2	2	Decon Techs	
294	TAN	Hot Cell Annex	633	TAN-607-2			MET cell	External Radiation	37	Low	1	2	2	Decon Techs	
295	TAN	Hot Cell Annex	633	TAN-607-2			MET cell	Internal Radiation	37	Low	1	2	2	Decon Techs	
271	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	External Radiation	33	Low	1	8	8	Decon Techs	
278	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	halfnium	35	Medium	5	2	10	Decon Techs	
279	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	cadmium	35	Medium	5	2	10	Decon Techs	
280	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	nickel	35	Medium	5	2	10	Decon Techs	
281	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	silver	35	Medium	5	2	10	Decon Techs	
282	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	gold	35	Medium	5	2	10	Decon Techs	
283	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	platinum	35	Medium	5	2	10	Decon Techs	
284	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	Lead	35	Medium	5	2	10	Decon Techs	
285	TAN	Hot Cell Annex	633	TAN-607-2			Hot Cell Annex	mercury	35	Medium	5	2	10	Decon Techs	
286	TAN	Hot Cell Annex	633	TAN-607-2			MET cell	HF	36	Medium	5	2	10	Decon Techs	
287	TAN	Hot Cell Annex	633	TAN-607-2			MET cell	Nitric Acid	36	Medium	5	2	10	Decon Techs	
288	TAN	Hot Cell Annex	633	TAN-607-2			MET cell	Sulfuric Acid	36	Medium	5	2	10	Decon Techs	
289	TAN	Hot Cell Annex	633	TAN-607-2			MET cell	sodium hydroxide	36	Medium	5	2	10	Decon Techs	
292	TAN	Hot Cell Annex	633	TAN-607-2			Two Cells	External Radiation	37	Medium	5	2	10	Decon Techs	
293	TAN	Hot Cell Annex	633	TAN-607-2			Two Cells	Internal Radiation	37	Medium	5	2	10	Decon Techs	
290	TAN	Hot Cell Annex	633	TAN-607-2			Decon Cell	External Radiation	37	High	10	2	20	Decon Techs	
291	TAN	Hot Cell Annex	633	TAN-607-2			Decon Cell	Internal Radiation	37	High	10	2	20	Decon Techs	
619	TRA	Materials Test Reactor	603	TR603-1			Entire Building	cadmium	7	Low	1	2	2	process operator	
623	TRA	Materials Test Reactor	603	TR603-1			Entire Building	welding fumes	9	Low	1	2	2	welder	
624	TRA	Materials Test Reactor	603	TR603-1			Entire Building	welding fumes	9	Low	1	2	2	pipefitter	
634	TRA	Materials Test Reactor	603	TR603-1			Entire Building	asbestos	18	Low	1	2	2	insulators	
635	TRA	Materials Test Reactor	603	TR603-1			Entire Building	asbestos	18	Low	1	2	2	process operator	
636	TRA	Materials Test Reactor	603	TR603-1			Entire Building	asbestos	18	Low	1	2	2	mechanic	
637	TRA	Materials Test Reactor	603	TR603-1			Entire Building	asbestos	18	Low	1	2	2	pipefitter	
652	TRA	Materials Test Reactor	603	TR603-B			basement floor	solvents	24	Low	1	2	2	process operator	
656	TRA	Materials Test Reactor	603	TR603-B			Canal	beryllium	26	Low	1	2	2	process operator	

ID	Comments
491	
205	
218	Decon tanks were kept to boiling point most of the time
261	often got admin limit (1 interviewee 63R, 1 45R lifetime dose)
265	
270	
307	non-destructive testing (NDT) using x-rays
309	
315	
329	
330	
331	
332	
333	
334	
335	
336	
337	
338	
339	
272	sometimes this area was a shoe cover area
273	mostly remote; some hands on cleaning
274	mostly remote; some hands on cleaning
275	mostly remote; some hands on cleaning
276	mostly remote; some hands on cleaning
277	mostly remote; some hands on cleaning
294	
295	
271	general area 10-12mr/hr
278	metals cut inside the cells
279	metals cut inside the cells
280	metals cut inside the cells
281	metals cut inside the cells
282	metals cut inside the cells
283	metals cut inside the cells
284	metals cut inside the cells
285	metals cut inside the cells
286	
287	
288	
289	
292	
293	
290	
291	
619	
623	
624	
634	
635	
636	
637	
652	
656	stored in canal when making repairs

Risk Mapping Results
Priority Buildings from TAN, CPP, TRA and CFA

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
658	TRA	Materials Test Reactor	603	TR603-B			water treatment	Nitric Acid	27	Low	1	2	2	process operator	
632	TRA	Materials Test Reactor	603	TR603-1			Canal	Internal Radiation	16	Low	1	8	8	process operator	
633	TRA	Materials Test Reactor	603	TR603-1			Canal	Internal Radiation	16	Low	1	8	8	mechanic	
625	TRA	Materials Test Reactor	603	TR603-1			Entire Building	mercury	10	Medium	5	2	10	process operator	
626	TRA	Materials Test Reactor	603	TR603-1			Entire Building	mercury	10	Medium	5	2	10	laborer	
661	TRA	Materials Test Reactor	603	TR603-B			experimental cubical	External Radiation	29	Medium	5	2	10	process operator	
662	TRA	Materials Test Reactor	603	TR603-2			Third Floor	External Radiation	30	Medium	5	2	10	HP Techs	
663	TRA	Materials Test Reactor	603	TR603-2			Third Floor	External Radiation	30	Medium	5	2	10	equipment operator	
601	TRA	Materials Test Reactor	603	TR603-1			Entire Building	carbon tetrachloride	1	High	10	2	20	process operator	
602	TRA	Materials Test Reactor	603	TR603-1			Entire Building	carbon tetrachloride	1	High	10	2	20	Reactor operator	
603	TRA	Materials Test Reactor	603	TR603-1			Entire Building	carbon tetrachloride	1	High	10	2	20	laborer	
604	TRA	Materials Test Reactor	603	TR603-1			Entire Building	carbon tetrachloride	1	High	10	2	20	mechanic	
605	TRA	Materials Test Reactor	603	TR603-1			Entire Building	stoddard solvent	2	High	10	2	20	process operator	
606	TRA	Materials Test Reactor	603	TR603-1			Entire Building	stoddard solvent	2	High	10	2	20	Reactor operator	
607	TRA	Materials Test Reactor	603	TR603-1			Entire Building	stoddard solvent	2	High	10	2	20	laborer	
608	TRA	Materials Test Reactor	603	TR603-1			Entire Building	stoddard solvent	2	High	10	2	20	mechanic	
609	TRA	Materials Test Reactor	603	TR603-1			Entire Building	acid	3	High	10	2	20	process operator	
610	TRA	Materials Test Reactor	603	TR603-1			Entire Building	acid	3	High	10	2	20	Reactor operator	
611	TRA	Materials Test Reactor	603	TR603-1			Entire Building	acid	3	High	10	2	20	laborer	
612	TRA	Materials Test Reactor	603	TR603-1			Entire Building	acid	3	High	10	2	20	mechanic	
613	TRA	Materials Test Reactor	603	TR603-1			Entire Building	carbon tetrachloride	4	High	10	2	20	process operator	
614	TRA	Materials Test Reactor	603	TR603-1			Entire Building	stoddard solvent	5	High	10	2	20	process operator	
615	TRA	Materials Test Reactor	603	TR603-1			Entire Building	lead	6	High	10	2	20	process operator	
616	TRA	Materials Test Reactor	603	TR603-1			Entire Building	lead	6	High	10	2	20	laborer	
617	TRA	Materials Test Reactor	603	TR603-1			Entire Building	lead	6	High	10	2	20	mechanic	
618	TRA	Materials Test Reactor	603	TR603-1			Entire Building	lead	6	High	10	2	20	pipefitter	
620	TRA	Materials Test Reactor	603	TR603-1			Entire Building	beryllium	8	High	10	2	20	process operator	
621	TRA	Materials Test Reactor	603	TR603-1			Entire Building	beryllium	8	High	10	2	20	mechanic	
622	TRA	Materials Test Reactor	603	TR603-1			Entire Building	beryllium	8	High	10	2	20	equipment operator	
628	TRA	Materials Test Reactor	603	TR603-1			Core Perimeter	External Radiation	12	High	10	2	20	process operator	
629	TRA	Materials Test Reactor	603	TR603-1			Core Perimeter	Internal Radiation	12	High	10	2	20	process operator	
639	TRA	Materials Test Reactor	603	TR603-B			subpile room	External Radiation	19	High	10	2	20	mechanic	
640	TRA	Materials Test Reactor	603	TR603-B			subpile room	External Radiation	19	High	10	2	20	pipefitter	
641	TRA	Materials Test Reactor	603	TR603-B			subpile room	External Radiation	19	High	10	2	20	welder	
642	TRA	Materials Test Reactor	603	TR603-B			subpile room	External Radiation	19	High	10	2	20	EPROs	
643	TRA	Materials Test Reactor	603	TR603-B			decon room	External Radiation	20	High	10	2	20	process operator	
644	TRA	Materials Test Reactor	603	TR603-B			decon room	External Radiation	20	High	10	2	20	mechanic	
645	TRA	Materials Test Reactor	603	TR603-B			decon room	Internal Radiation	20	High	10	2	20	process operator	
646	TRA	Materials Test Reactor	603	TR603-B			decon room	Internal Radiation	20	High	10	2	20	mechanic	
647	TRA	Materials Test Reactor	603	TR603-B			Canal	External Radiation	21	High	10	2	20	process operator	
649	TRA	Materials Test Reactor	603	TR603-B			Canal	External Radiation	22	High	10	2	20	mechanic	
653	TRA	Materials Test Reactor	603	TR603-B			basement floor	lead	25	High	10	2	20	mechanic	
654	TRA	Materials Test Reactor	603	TR603-B			basement floor	lead	25	High	10	2	20	laborer	
655	TRA	Materials Test Reactor	603	TR603-B			basement floor	lead	25	High	10	2	20	process operator	
657	TRA	Materials Test Reactor	603	TR603-B			Canal	beryllium	26	High	10	2	20	mechanic	
627	TRA	Materials Test Reactor	603	TR603-1			Entire Building	External Radiation	11	High	10	4	40	process operator	
630	TRA	Materials Test Reactor	603	TR603-1			Canal	External Radiation	16	Medium	5	8	40	process operator	
631	TRA	Materials Test Reactor	603	TR603-1			Canal	External Radiation	16	Medium	5	8	40	mechanic	
638	TRA	Materials Test Reactor	603	TR603-B			subpile room	External Radiation	19	High	10	8	80	process operator	
648	TRA	Materials Test Reactor	603	TR603-B			Canal	External Radiation	22	High	10	8	80	process operator	
650	TRA	Materials Test Reactor	603	TR603-B			decon room	solvents	23	High	10	8	80	process operator	
651	TRA	Materials Test Reactor	603	TR603-B			decon room	solvents	23	High	10	8	80	mechanic	
659	TRA	Materials Test Reactor	603	TR603-B			basement floor	noise	28	High	10	8	80	process operator	

ID	Comments
491	
658	
632	
633	
625	accident; large spill unknown source
626	accident; large spill unknown source
661	
662	when moving fuel
663	when moving fuel
601	used for decon
602	used for decon
603	used for decon
604	used for decon
605	used for decon
606	used for decon
607	used for decon
608	used for decon
609	used for decon
610	used for decon
611	used for decon
612	used for decon
613	floor cleaning
614	floor cleaning
615	
616	
617	
618	
620	
621	
622	
628	experiments inserted around reactor (gamma,neutron)
629	experiments inserted around reactor (some alpha)
639	
640	
641	
642	
643	working on pumps caused highest exposures
644	working on pumps caused highest exposures
645	working on pumps caused highest exposures
646	working on pumps caused highest exposures
647	dry loading of casks
649	
653	
654	
655	
657	stored in canal when making repairs
627	fuel element removal; every 3 weeks (sometimes 4-5 days)
630	
631	
638	
648	
650	
651	
659	

Risk Mapping Results
Priority Buildings from TAN, CPP, TRA and CFA

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
660	TRA	Materials Test Reactor	603	TR603-B			basement floor	noise	28	High	10	8	80	mechanic	
668	TRA	Engineering Test Reactor	642	TR642-1			Entire Building	stoddard solvent	3	Low	1	0.025	0.025	process operator	
664	TRA	Engineering Test Reactor	642	TR642-1			Entire Building	TCE	1	Low	1	0.1	0.1	process operator	
665	TRA	Engineering Test Reactor	642	TR642-1			Entire Building	TCE	1	Low	1	0.1	0.1	mechanic	
666	TRA	Engineering Test Reactor	642	TR642-1			Entire Building	TCE	1	Low	1	0.1	0.1	HP Techs	
708	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	asbestos	19	very low	0.1	2	0.2	process operator	
709	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	asbestos	19	very low	0.1	2	0.2	mechanic	
710	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	asbestos	19	very low	0.1	2	0.2	reactor engineer	
711	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	asbestos	19	very low	0.1	2	0.2	pipefitter	
694	TRA	Engineering Test Reactor	642	TR642-1			Battery Room	sulfuric acid	15	Low	1	0.25	0.25	process operator	
695	TRA	Engineering Test Reactor	642	TR642-1			Battery Room	sulfuric acid	15	Low	1	0.25	0.25	electrician	
669	TRA	Engineering Test Reactor	642	TR642-1			Entire Building	Turco xx	4	Medium	5	0.1	0.5	process operator	
670	TRA	Engineering Test Reactor	642	TR642-1			Entire Building	dowtal	5	Low	1	1	1	process operator	
685	TRA	Engineering Test Reactor	642	TR642-1			SLSF	sodium	11	Low	1	1	1	mechanic	
686	TRA	Engineering Test Reactor	642	TR642-1			SLSF	sodium	11	Low	1	1	1	HP Techs	
687	TRA	Engineering Test Reactor	642	TR642-1			SLSF	sodium	11	Low	1	1	1	reactor engineer	
688	TRA	Engineering Test Reactor	642	TR642-1			SLSF	sodium	11	Low	1	1	1	pipefitter	
689	TRA	Engineering Test Reactor	642	TR642-1			SLSF	sodium	11	Low	1	1	1	welder	
696	TRA	Engineering Test Reactor	642	TR642-1			Resin Bed Tanks	sodium hydroxide	16	Low	1	1	1	process operator	
697	TRA	Engineering Test Reactor	642	TR642-1			Resin Bed Tanks	sodium hydroxide	16	Low	1	1	1	pipefitter	
667	TRA	Engineering Test Reactor	642	TR642-1			Entire Building	Acetone	2	Low	1	2	2	HP Techs	
671	TRA	Engineering Test Reactor	642	TR642-1			reactor shielding	powdered lead	6	Low	1	2	2	process operator	
672	TRA	Engineering Test Reactor	642	TR642-1			reactor shielding	powdered lead	6	Low	1	2	2	mechanic	
673	TRA	Engineering Test Reactor	642	TR642-1			reactor shielding	lead	6	Low	1	2	2	process operator	
674	TRA	Engineering Test Reactor	642	TR642-1			reactor shielding	lead	6	Low	1	2	2	mechanic	
675	TRA	Engineering Test Reactor	642	TR642-1	62	64	Nozzle trench	beryllium	7	Low	1	2	2	process operator	
676	TRA	Engineering Test Reactor	642	TR642-1	62	64	Nozzle trench	beryllium	7	Low	1	2	2	HP Techs	
677	TRA	Engineering Test Reactor	642	TR642-1	62	64	Nozzle trench	beryllium	7	Low	1	2	2	reactor engineer	
678	TRA	Engineering Test Reactor	642	TR642-1			reactor shielding	cadmium	8	Low	1	2	2	process operator	
679	TRA	Engineering Test Reactor	642	TR642-1			reactor shielding	cadmium	8	Low	1	2	2	reactor engineer	
680	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	nickel	9	Low	1	2	2	pipefitter	
681	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	nickel	9	Low	1	2	2	welder	
682	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	nickel	9	Low	1	2	2	mechanic	
683	TRA	Engineering Test Reactor	642	TRA-642-2			1st basement	mercury	10	Low	1	2	2	process operator	
684	TRA	Engineering Test Reactor	642	TRA-642-2			1st basement	mercury	10	Low	1	2	2	reactor engineer	
690	TRA	Engineering Test Reactor	642	TR642-1			primary water system	Nitric Acid	12	Low	1	2	2	process operator	
691	TRA	Engineering Test Reactor	642	TR642-1			secondary water system	sulfuric acid	13	Low	1	2	2	process operator	
692	TRA	Engineering Test Reactor	642	TR642-1			secondary water system	sulfuric acid	13	Low	1	2	2	mechanic	
693	TRA	Engineering Test Reactor	642	TR642-1			Chlorine Room	chlorine	14	Low	1	2	2	process operator	
715	TRA	Engineering Test Reactor	642	TRA-642-2			console floor	lead	22	Low	1	2	2	process operator	
716	TRA	Engineering Test Reactor	642	TRA-642-2			console floor	lead	22	Low	1	2	2	HP Techs	
717	TRA	Engineering Test Reactor	642	TRA-642-2			console floor	lead	22	Low	1	2	2	mechanic	
718	TRA	Engineering Test Reactor	642	TRA-642-2			console floor	External Radiation	23	Low	1	2	2	process operator	
719	TRA	Engineering Test Reactor	642	TRA-642-2			console floor	External Radiation	23	Low	1	2	2	HP Techs	
720	TRA	Engineering Test Reactor	642	TRA-642-2			console floor	External Radiation	23	Low	1	2	2	mechanic	
721	TRA	Engineering Test Reactor	642	TRA-642-2			console floor	Internal Radiation	23	Low	1	2	2	process operator	
722	TRA	Engineering Test Reactor	642	TRA-642-2			console floor	Internal Radiation	23	Low	1	2	2	HP Techs	
723	TRA	Engineering Test Reactor	642	TRA-642-2			console floor	Internal Radiation	23	Low	1	2	2	mechanic	
701	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	Internal Radiation	18	Medium	5	2	10	process operator	
702	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	Internal Radiation	18	Medium	5	2	10	HP Techs	
703	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	Internal Radiation	18	Medium	5	2	10	reactor engineer	
704	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	Internal Radiation	18	Medium	5	2	10	sponser engineer	
705	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	Internal Radiation	18	Medium	5	2	10	pipefitter	

ID	Comments
491	
660	
668	
664	used to mop floors
665	used to mop floors
666	used to mop floors
708	
709	
710	
711	
694	
695	
669	equipment and personnel decon.
670	dow chemical product; used gloves
685	fire in 78-80
686	fire in 78-80
687	fire in 78-80
688	fire in 78-80
689	fire in 78-80
696	
697	
667	
671	powdered lead mixed to fill cracks in lead shielding
672	powdered lead mixed to fill cracks in lead shielding
673	handling lead shielding
674	handling lead shielding
675	beryllium change out; new beryllium machined in TRA-653
676	beryllium change out; new beryllium machined in TRA-653
677	beryllium change out; new beryllium machined in TRA-653
678	
679	
680	resp. used due to rad
681	resp. used due to rad
682	resp. used due to rad
683	used very little; recalled one small spill
684	used very little; recalled one small spill
690	
691	
692	
693	used airline and bubble suit
715	handling shielding
716	handling shielding
717	handling shielding
718	general area 2-3 mr/hr
719	general area 2-3 mr/hr
720	general area 2-3 mr/hr
721	low level contamination
722	low level contamination
723	low level contamination
701	main concern beta
702	main concern beta
703	main concern beta
704	main concern beta
705	main concern beta

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
706	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	Internal Radiation	18	Medium	5	2	10	mechanic	
707	TRA	Engineering Test Reactor	642	TR642-1			Nozzle trench	Internal Radiation	18	Medium	5	2	10	utility operator	
714	TRA	Engineering Test Reactor	642	TRA-642-2			console floor	TCE	21	Medium	5	2	10	process operator	
724	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	TCE	24	High	10	2	20	process operator	
725	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	TCE	24	High	10	2	20	reactor engineer	
726	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	lead	25	High	10	2	20	process operator	
727	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	lead	25	High	10	2	20	mechanic	
728	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	lead	25	High	10	2	20	welder	
729	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	welding fumes	26	High	10	2	20	welder	
730	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	welding fumes	26	High	10	2	20	pipefitter	
731	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	welding fumes	26	High	10	2	20	mechanic	
732	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	Internal Radiation	27	High	10	2	20	process operator	10
733	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	Internal Radiation	27	High	10	2	20	mechanic	10
734	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	Internal Radiation	27	High	10	2	20	pipefitter	10
735	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	Internal Radiation	27	High	10	2	20	electrician	10
736	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	Internal Radiation	27	High	10	2	20	welder	10
737	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	Internal Radiation	27	High	10	2	20	HP Techs	10
738	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	Internal Radiation	27	High	10	2	20	Instrument Tech	10
739	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	Internal Radiation	27	High	10	2	20	insulators	10
740	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	External Radiation	28	High	10	2	20	process operator	10
741	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	External Radiation	28	High	10	2	20	mechanic	10
742	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	External Radiation	28	High	10	2	20	pipefitter	10
743	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	External Radiation	28	High	10	2	20	electrician	10
744	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	External Radiation	28	High	10	2	20	welder	10
745	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	External Radiation	28	High	10	2	20	HP Techs	10
746	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	External Radiation	28	High	10	2	20	Instrument Tech	10
747	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	External Radiation	28	High	10	2	20	insulators	10
748	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	heat	29	High	10	2	20	process operator	10
749	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	heat	29	High	10	2	20	mechanic	10
750	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	heat	29	High	10	2	20	pipefitter	10
751	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	heat	29	High	10	2	20	electrician	10
752	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	heat	29	High	10	2	20	welder	10
753	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	heat	29	High	10	2	20	HP Techs	10
754	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	heat	29	High	10	2	20	Instrument Tech	10
755	TRA	Engineering Test Reactor	642	TRA-642-B			subpile room	heat	29	High	10	2	20	insulators	10
698	TRA	Engineering Test Reactor	642	TR642-1			Resin Bed Tanks	External Radiation	17	High	10	4	40	process operator	
699	TRA	Engineering Test Reactor	642	TR642-1			Resin Bed Tanks	External Radiation	17	High	10	4	40	mechanic	
700	TRA	Engineering Test Reactor	642	TR642-1			Resin Bed Tanks	External Radiation	17	High	10	4	40	reactor engineer	
712	TRA	Engineering Test Reactor	642	TR642-1			diesel generators	noise	20	High	10	8	80	process operator	
713	TRA	Engineering Test Reactor	642	TR642-1			diesel generators	noise	20	High	10	8	80	mechanic	
756	TRA	Machine Shop	653	TRA-653-H			Degreaser Area	stoddard solvent	1	Low	1	2	2	machinist	
758	TRA	Machine Shop	653	TRA-653-H			general shop area	Acetone	2	Low	1	2	2	machinist	
759	TRA	Machine Shop	653	TRA-653-H			general shop area	Acetone	2	Low	1	2	2	laborer	
763	TRA	Machine Shop	653	TRA-653-H			general shop area	beryllium	5	Low	1	2	2	machinist	
764	TRA	Machine Shop	653	TRA-653-H			general shop area	cadmium	6	Low	1	2	2	machinist	
768	TRA	Machine Shop	653	TRA-653-H			general shop area	chromium	9	Low	1	2	2	machinist	
769	TRA	Machine Shop	653	TRA-653-H			general shop area	copper	10	Low	1	2	2	machinist	
770	TRA	Machine Shop	653	TRA-653-H			general shop area	Nitric Acid	11	Low	1	2	2	machinist	
771	TRA	Machine Shop	653	TRA-653-H			general shop area	sulfuric acid	12	Low	1	2	2	machinist	
774	TRA	Machine Shop	653	TRA-653-H			general shop area	asbestos	14	Low	1	2	2	machinist	
775	TRA	Machine Shop	653	TRA-653-H			general shop area	asbestos	14	Low	1	2	2	laborer	
776	TRA	Machine Shop	653	TRA-653-H			general shop area	asbestos	14	Low	1	2	2	custodian	
777	TRA	Machine Shop	653	TRA-653-H			general shop area	asbestos	14	Low	1	2	2	painter	

ID	Comments
491	
706	main concern beta
707	main concern beta
714	especially bad under elevator
724	used heavily in this area prior to maint. Work
725	used heavily in this area prior to maint. Work
726	lead sawing with gloves; no resp usually
727	lead sawing with gloves; no resp usually
728	lead sawing with gloves; no resp usually
729	fresh air resp.
730	fresh air resp.
731	fresh air resp.
732	most work during shutdown; used ETR craft people to help
733	most work during shutdown; used ETR craft people to help
734	most work during shutdown; used ETR craft people to help
735	most work during shutdown; used ETR craft people to help
736	most work during shutdown; used ETR craft people to help
737	most work during shutdown; used ETR craft people to help
738	most work during shutdown; used ETR craft people to help
739	most work during shutdown; used ETR craft people to help
740	general area 4-5R/hr; hot spots of 20R/hr
741	general area 4-5R/hr; hot spots of 20R/hr
742	general area 4-5R/hr; hot spots of 20R/hr
743	general area 4-5R/hr; hot spots of 20R/hr
744	general area 4-5R/hr; hot spots of 20R/hr
745	general area 4-5R/hr; hot spots of 20R/hr
746	general area 4-5R/hr; hot spots of 20R/hr
747	general area 4-5R/hr; hot spots of 20R/hr
748	
749	
750	
751	
752	
753	
754	
755	
698	general area 5R/h (Range 1-50R/hr(on resin))
699	general area 5R/h (Range 1-50R/hr(on resin))
700	general area 5R/h (Range 1-50R/hr(on resin))
712	approx 120 dBa; hearing protection used very little
713	approx 120 dBa; hearing protection used very little
756	
758	
759	
763	used "coffer dams" with water when working with Be; used half faced resp.
764	no PPE
768	
769	
770	
771	
774	
775	
776	
777	

Risk Mapping Results
Priority Buildings from TAN, CPP, TRA and CFA

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
778	TRA	Machine Shop	653	TRA-653-H			general shop area	asbestos	14	Low	1	2	2	mechanic	
779	TRA	Machine Shop	653	TRA-653-H			general shop area	asbestos	14	Low	1	2	2	welder	
780	TRA	Machine Shop	653	TRA-653-H			general shop area	asbestos	14	Low	1	2	2	foreman	
782	TRA	Machine Shop	653	TRA-653-H			general shop area	ceramics	16	Low	1	2	2	machinist	
783	TRA	Machine Shop	653	TRA-653-H			general shop area	ethanol	17	Low	1	2	2	machinist	
757	TRA	Machine Shop	653	TRA-653-H			Degreaser Area	stoddard solvent	1	Medium	5	2	10	mechanic	
765	TRA	Machine Shop	653	TRA-653-H			general shop area	nickel	7	Medium	5	2	10	machinist	
772	TRA	Machine Shop	653	TRA-653-H			general shop area	External Radiation	13	Medium	5	2	10	machinist	
773	TRA	Machine Shop	653	TRA-653-H			general shop area	Internal Radiation	13	Medium	5	2	10	machinist	
784	TRA	Machine Shop	653	TRA-653-H			general shop area	silica	18	Medium	5	2	10	machinist	
785	TRA	Machine Shop	653	TRA-653-H			general shop area	silica	18	Medium	5	2	10	welder	
761	TRA	Machine Shop	653	TRA-653-H			general shop area	lead	4	High	10	2	20	machinist	
762	TRA	Machine Shop	653	TRA-653-H			general shop area	lead	4	High	10	2	20	laborer	
766	TRA	Machine Shop	653	TRA-653-H			general shop area	welding fumes	8	High	10	2	20	machinist	
767	TRA	Machine Shop	653	TRA-653-H			general shop area	welding fumes	8	High	10	2	20	welder	
760	TRA	Machine Shop	653	TRA-653-H	55	65	general shop area	TCE	3	Medium	5	8	40	machinist	
781	TRA	Machine Shop	653	TRA-653-H			general shop area	noise	15	High	10	8	80	machinist	
551	TRA	Advandced Test Reactor	670	TR670-1F			nitric pumps	Nitric Acid	10	Low	1	0.25	0.25	process operator	
568	TRA	Advandced Test Reactor	670	TR670-1B			decon room	Turco xx	16	Low	1	0.25	0.25	laborer	
566	TRA	Advandced Test Reactor	670	TR670-1B			Repair Room	IPA	15	Low	1	0.5	0.5	mechanic	
567	TRA	Advandced Test Reactor	670	TR670-1B			Repair Room	Acetone	15	Low	1	0.5	0.5	mechanic	
561	TRA	Advandced Test Reactor	670	TR670-1F			primary pumps	External Radiation	13	Low	1	1	1	mechanic	
562	TRA	Advandced Test Reactor	670	TR670-1F			primary pumps	External Radiation	13	Low	1	1	1	process operator	
563	TRA	Advandced Test Reactor	670	TR670-1F			primary pumps	External Radiation	13	Low	1	1	1	pipefitter	
583	TRA	Advandced Test Reactor	670	TR670-1B			Primary pump corridor	noise	22	Low	1	1	1	process operator	
584	TRA	Advandced Test Reactor	670	TR670-1B			Primary pump corridor	noise	22	Low	1	1	1	mechanic	
585	TRA	Advandced Test Reactor	670	TR670-1B			Primary pump corridor	noise	22	Low	1	1	1	Reactor operator	
595	TRA	Advandced Test Reactor	670	TR670-3B			Rod Access Floor	External Radiation	27	Low	1	1	1	mechanic	
597	TRA	Advandced Test Reactor	670	TR670-3B			Rod Access Floor	Internal Radiation	27	Low	1	1	1	mechanic	
599	TRA	Advandced Test Reactor	670	TR670-1M			HVS-1	noise	28	Low	1	1	1	process operator	
600	TRA	Advandced Test Reactor	670	TR670-1M			HVS-2,3,4	noise	28	Low	1	1	1	process operator	
523	TRA	Advandced Test Reactor	670	TR670-1F			Tool Repair Area	Acetone	1	Low	1	2	2	mechanic	
524	TRA	Advandced Test Reactor	670	TR670-1F			Tool Repair Area	Acetone	1	Low	1	2	2	welder	
525	TRA	Advandced Test Reactor	670	TR670-1F			Tool Repair Area	Acetone	1	Low	1	2	2	HP Techs	
526	TRA	Advandced Test Reactor	670	TR670-1F			Tool Repair Area	TCE	1	Low	1	2	2	mechanic	
527	TRA	Advandced Test Reactor	670	TR670-1F			Tool Repair Area	TCE	1	Low	1	2	2	welder	
528	TRA	Advandced Test Reactor	670	TR670-1F			Tool Repair Area	TCE	1	Low	1	2	2	HP Techs	
529	TRA	Advandced Test Reactor	670	TR670-1F			Instrument Shop	Acetone	2	Low	1	2	2	Reactor Instrument Tech	
530	TRA	Advandced Test Reactor	670	TR670-1F			Instrument Shop	IPA	3	Low	1	2	2	Reactor Instrument Tech	
543	TRA	Advandced Test Reactor	670	TR670-1F	80	91	Entire Building	beryllium	8	Low	1	2	2	mechanic	
544	TRA	Advandced Test Reactor	670	TR670-1F	80	91	Entire Building	beryllium	8	Low	1	2	2	pipefitter	
545	TRA	Advandced Test Reactor	670	TR670-1F	80	91	Entire Building	beryllium	8	Low	1	2	2	equipment operator	
546	TRA	Advandced Test Reactor	670	TR670-1F	80	91	Entire Building	beryllium	8	Low	1	2	2	Reactor operator	
547	TRA	Advandced Test Reactor	670	TR670-1F			Hot Sample Room	citric acid	9	Low	1	2	2	Reactor operator	
548	TRA	Advandced Test Reactor	670	TR670-1F			Hot Sample Room	acetic acid	9	Low	1	2	2	Reactor operator	
549	TRA	Advandced Test Reactor	670	TR670-1F			Hot Sample Room	Nitric Acid	9	Low	1	2	2	Reactor operator	
550	TRA	Advandced Test Reactor	670	TR670-1F			Hot Sample Room	sulfuric acid	9	Low	1	2	2	Reactor operator	
552	TRA	Advandced Test Reactor	670	TR670-1F			nitric pumps	Nitric Acid	10	Low	1	2	2	mechanic	
553	TRA	Advandced Test Reactor	670	TR670-1F			reactor core	External Radiation	11	Low	1	2	2	mechanic	
554	TRA	Advandced Test Reactor	670	TR670-1F			reactor core	External Radiation	11	Low	1	2	2	pipefitter	
555	TRA	Advandced Test Reactor	670	TR670-1F			reactor core	External Radiation	11	Low	1	2	2	welder	
556	TRA	Advandced Test Reactor	670	TR670-1F			reactor core	External Radiation	11	Low	1	2	2	Reactor operator	
570	TRA	Advandced Test Reactor	670	TR670-1B			cubicles	lead	17	Low	1	2	2	mechanic	

ID	Comments
491	
778	
779	
780	
782	building up pump shafts; spraying
783	
757	
765	metalizing spray; also nickel from stainless steel work
772	in tent worked on contam. Items
773	in tent worked on contam. Items
784	sandblasting
785	sandblasting
761	
762	poured, drilled, milled; No PPE in the "early" years
766	6 years while weld shop was housed in 653
767	6 years while weld shop was housed in 653
760	stopped using in approx. 1965
781	
551	
568	used with ultrasonic cleaning tank
566	repair of safety rods
567	repair of safety rods
561	less than 10 mr/hr general area
562	less than 10 mr/hr general area
563	less than 10 mr/hr general area
583	greater than 100 dBa; hearing prot. Required
584	greater than 100 dBa; hearing prot. Required
585	greater than 100 dBa; hearing prot. Required
595	
597	
599	wore ear protection
600	wore ear protection
523	
524	
525	
526	
527	
528	
529	
530	
543	Beryllium Change-outs(1980,1985,1991)
544	Beryllium Change-outs(1980,1985,1991)
545	Beryllium Change-outs(1980,1985,1991)
546	Beryllium Change-outs(1980,1985,1991)
547	
548	
549	
550	
552	
553	10-20 mr/hr average field; higher hot spots
554	10-20 mr/hr average field; higher hot spots
555	10-20 mr/hr average field; higher hot spots
556	10-20 mr/hr average field; higher hot spots
570	resp. required

ID	Facility	Building Name	Bldg	Map	Start	Stop	Process/	Chemical/	Dot	Exp	Rank	Freq	DF	Job	Num
491	CFA	Old Machine Shop	640	CF-640	55	79	Entire Building	TCE	1	Low	1	2	2	machinist	16
571	TRA	Advandced Test Reactor	670	TR670-1B			cubicles	lead	17	Low	1	2	2	pipefitter	
572	TRA	Advandced Test Reactor	670	TR670-1B			cubicles	lead	17	Low	1	2	2	HP Techs	
573	TRA	Advandced Test Reactor	670	TR670-1B			sample corridor	Nitric Acid	18	Low	1	2	2	Reactor operator	
574	TRA	Advandced Test Reactor	670	TR670-1B			Heat Exchanger Area	External Radiation	19	Low	1	2	2	process operator	
575	TRA	Advandced Test Reactor	670	TR670-1B			Heat Exchanger Area	External Radiation	19	Low	1	2	2	mechanic	
576	TRA	Advandced Test Reactor	670	TR670-1B			cubicles	External Radiation	20	Low	1	2	2	mechanic	
577	TRA	Advandced Test Reactor	670	TR670-1B			cubicles	External Radiation	20	Low	1	2	2	pipefitter	
578	TRA	Advandced Test Reactor	670	TR670-1B			cubicles	External Radiation	20	Low	1	2	2	process operator	
579	TRA	Advandced Test Reactor	670	TR670-1B			cubicles	External Radiation	20	Low	1	2	2	Reactor operator	
580	TRA	Advandced Test Reactor	670	TR670-1B			safety rod corridor	External Radiation	21	Low	1	2	2	mechanic	
581	TRA	Advandced Test Reactor	670	TR670-1B			safety rod corridor	External Radiation	21	Low	1	2	2	process operator	
582	TRA	Advandced Test Reactor	670	TR670-1B			safety rod corridor	External Radiation	21	Low	1	2	2	HP Techs	
586	TRA	Advandced Test Reactor	670	TR670-2B			Pile Area	Acetone	23	Low	1	2	2	mechanic	
587	TRA	Advandced Test Reactor	670	TR670-2B			Pile Area	IPA	23	Low	1	2	2	mechanic	
588	TRA	Advandced Test Reactor	670	TR670-2B			Pile Area	lead	24	Low	1	2	2	mechanic	
589	TRA	Advandced Test Reactor	670	TR670-2B			Bypass Demand Regeneration	sulfuric acid	25	Low	1	2	2	process operator	
590	TRA	Advandced Test Reactor	670	TR670-2B			Bypass Demand Regeneration	sodium hydroxide	25	Low	1	2	2	process operator	
591	TRA	Advandced Test Reactor	670	TR670-2B			Exhaust Blower Room	noise	26	Low	1	2	2	mechanic	
592	TRA	Advandced Test Reactor	670	TR670-2B			Exhaust Blower Room	noise	26	Low	1	2	2	process operator	
593	TRA	Advandced Test Reactor	670	TR670-2B			Exhaust Blower Room	noise	26	Low	1	2	2	Reactor operator	
594	TRA	Advandced Test Reactor	670	TR670-2B			Exhaust Blower Room	noise	26	Low	1	2	2	HP Techs	
596	TRA	Advandced Test Reactor	670	TR670-3B			Rod Access Floor	External Radiation	27	Low	1	2	2	process operator	
598	TRA	Advandced Test Reactor	670	TR670-3B			Rod Acess Floor	Internal Radiation	27	Low	1	2	2	process operator	
531	TRA	Advandced Test Reactor	670	TR670-1F			Entire Building	Turco xx	4	Low	1	8	8	laborer	
536	TRA	Advandced Test Reactor	670	TR670-1F			Tank/Nozzle Trench	welding fumes	7	Low	1	8	8	welder	
537	TRA	Advandced Test Reactor	670	TR670-1F			Weld Shop	welding fumes	7	Low	1	8	8	welder	
538	TRA	Advandced Test Reactor	670	TR670-1F			Repair Area	welding fumes	7	Low	1	8	8	welder	
569	TRA	Advandced Test Reactor	670	TR670-1B			cubicles	lead	17	Low	1	8	8	Reactor operator	
565	TRA	Advandced Test Reactor	670	TR670-1F			Diesel Generator Pit	noise	14	High	10	1	10	mechanic	
564	TRA	Advandced Test Reactor	670	TR670-1F			Deisel Generator Pit	noise	14	High	10	4	40	process operator	
539	TRA	Advandced Test Reactor	670	TR670-1F	70	80	Entire Building	beryllium	8	Medium	5	8	40	mechanic	
540	TRA	Advandced Test Reactor	670	TR670-1F	70	80	Entire Building	beryllium	8	Medium	5	8	40	pipefitter	
541	TRA	Advandced Test Reactor	670	TR670-1F	70	80	Entire Building	beryllium	8	Medium	5	8	40	equipment operator	
542	TRA	Advandced Test Reactor	670	TR670-1F	70	80	Entire Building	beryllium	8	Medium	5	8	40	Reactor operator	
557	TRA	Advandced Test Reactor	670	TR670-1F			Repair Area	External Radiation	12	Medium	5	8	40	mechanic	
558	TRA	Advandced Test Reactor	670	TR670-1F			Repair Area	External Radiation	12	Medium	5	8	40	welder	
559	TRA	Advandced Test Reactor	670	TR670-1F			Repair Area	Internal Radiation	12	Medium	5	8	40	mechanic	
560	TRA	Advandced Test Reactor	670	TR670-1F			Repair Area	Internal Radiation	12	Medium	5	8	40	welder	
532	TRA	Advandced Test Reactor	670	TR670-1F	70	80	Entire Building	lead	5	High	10	8	80	mechanic	
533	TRA	Advandced Test Reactor	670	TR670-1F	70	80	Entire Building	lead	5	High	10	8	80	laborer	
534	TRA	Advandced Test Reactor	670	TR670-1F	70	80	Lead Fabrication	lead	6	High	10	8	80	mechanic	
535	TRA	Advandced Test Reactor	670	TR670-1F	70	80	Lead Fabrication	lead	6	High	10	8	80	laborer	

ID	Comments
491	
571	resp. required
572	resp. required
573	
574	5-10 mr/hr
575	5-10 mr/hr
576	10 mr/hr; some hot spots (used lead blankets during work)
577	10 mr/hr; some hot spots (used lead blankets during work)
578	10 mr/hr; some hot spots (used lead blankets during work)
579	10 mr/hr; some hot spots (used lead blankets during work)
580	approx. 10 mr/hr
581	approx. 10 mr/hr
582	approx. 10 mr/hr
586	
587	
588	moving lead bricks around pile and cubicles; wore PCs
589	
590	
591	
592	
593	
594	
596	
598	
531	floor decon throughout building
536	level A protection required (due to rad)
537	resp. required
538	resp. required
569	resp. required
565	> 100 dBa; last 15 yrs ear protection used
564	> 100 dBa; last 15 yrs ear protection used
539	During Beryllium Installation; filed bricks to fit
540	During Beryllium Installation; filed bricks to fit
541	During Beryllium Installation; filed bricks to fit
542	During Beryllium Installation; filed bricks to fit
557	10 mr/hr avg. field
558	10 mr/hr avg. field
559	early yrs. No resp. (last 7 years used resp)
560	early yrs. No resp. (last 7 years used resp)
532	direct handling of lead bricks in early years
533	direct handling of lead bricks in early years
534	cut lead blocks to fit (early years when started reactor)
535	cut lead blocks to fit (early years when started reactor)

Appendix B:

Risk Map Exposures

(Job Classification / Chemical)
count of all exposure entries (high, medium and low)

Appendix B1:

Matrix of Risk Mapping Exposures by Facility

Job Titles vs. Chemical/Agent
(TAN, TRA, CPP, CFA Risk Map Data

Chemical/	body men	bus drivers	carpenters	custodian	Decon Techs	electrician	EPROs	equipment operator	Experimental Machinist	foreman	Helper	Hot Cell Techs	HP Techs	Instrument Tech	insulators	laborer	machinist	mechanic	Operator	painter	parts men	pipefitter	process operator	quality assurance	reactor engineer	Reactor Instrument Tech	Reactor operator	sheet metal worker	sponser engineer	supervisor	technician	tool crib attendent	utility operator	welder	(blank)	Grand Total
cutting fluid																	1																			1
Acetic Acid					2							1															1									4
Acetone					5	2						1	2	1		5	2	6		1		4				1					1	1		4		36
acid																1		1					1				1									4
alcohol					2	1						1				1		1				1										1		1		9
alcohol																	1																			1
Ammon. Hydrox.																			1																	1
arc flashes																		1				1												1		3
arsenic																	1																			1
Asbestos			1	1	1	2				1				1	2	2	2	7	2	2		5	2		1					1		1		3		37
Benzene					1																															1
Beryllium					1			4	2			1	1			1	1	5				2	3		1		2									24
Boric Acid											1																									1
brazing flux																		1																		1
cadmium					2							1				1	2						2		1											9
cadmium Sulfate											1																									1
carbon monoxide																		1																		1
Carbon Tet.														1		1	1	1		1			2				1									8
ceramics																	1																			1
chlorine																							1													1
Chromic Acid											1																									1
Chromium									1							1	1	1		1		2												1		8
chromium																	1																			1
citric acid																											1									1
contact cement			1																																	1
copper					1	2			1			1				1	2																			8
cutting oils									1								1	1				1														4
dowtal																							1													1
epoxy																				1																1
ethanol																	1																			1
ethylene glycol																		1																		1

Job Titles vs. Chemical/Agent
(TAN, TRA, CPP, CFA Risk Map Data

Chemical/	body men	bus drivers	carpenters	custodian	Decon Techs	electrician	EPROs	equipment operator	Experimental Machinist	foreman	Helper	Hot Cell Techs	HP Techs	Instrument Tech	insulators	laborer	machinist	mechanic	Operator	painter	parts men	pipefitter	process operator	quality assurance	reactor engineer	Reactor Instrument Tech	Reactor operator	sheet metal worker	sponser engineer	supervisor	technician	tool crib attendent	utility operator	welder	(blank)	Grand Total
External Radiation					9	3	1	1	1		9		9	7	1	3	2	26	13	1		11	16	1	1		2				1			11		129
freon														1				1																		2
Gadalidium Oxide																			1																	1
gold					2							1				1																				4
granulated slag																1				1																2
halfnium					2							1				1																				4
HCl					1													1				1														3
Heat					4	2						1	2	1	1	2		4	1			5	1								1			3		28
herbicides																1																				1
Hexone											2								2																	4
HF					3						2		1	3				3	2																	14
Internal Radiation					8	2			1		5		7	6	1	2	1	14	9	1		5	7		1				1				1	7		79
IPA																		2								1										3
iron oxide																								1												1
Lead	1				5	1		1	1			1	2			10	4	17		2		5	5	1			1				1			5		63
lead fumes								1								1																		1		3
Lead Solder														1																						1
lifting hazard																		2																		2
maga glow																								1												1
Mercuric Nitrate											1																									1
Mercury					2									3		1							2		1											9
Methylene Chloride					4	1										3		2				2									1			1		14
MIBK														1				1	1																	3
motor oil																		1																		1
NaK													1					1	1			2												1		6
nickel					2				1			1				1	2	1				1												1		10
Nitric Acid					4	1					2	1	1	2			2	4	5			4	3				2							3		34
noise			1	1	1	2		1	1				2	1		4	2	9	1			5	7				2	1						5		46
paint stripper	1																	1																		2

Job Titles vs. Chemical/Agent
(TAN, TRA, CPP, CFA Risk Map Data

Chemical/	body men	bus drivers	carpenters	custodian	Decon Techs	electrician	EPROs	equipment operator	Experimental Machinist	foreman	Helper	Hot Cell Techs	HP Techs	Instrument Tech	insulators	laborer	machinist	mechanic	Operator	painter	parts men	pipefitter	process operator	quality assurance	reactor engineer	Reactor Instrument Tech	Reactor operator	sheet metal worker	sponser engineer	supervisor	technician	tool crib attendent	utility operator	welder	(blank)	Grand Total
paint thinner																				1																1
PCBs						2																														2
perchloroethylene					1											1																				2
pesticides																1																				1
platinum					1																															1
powdered lead																		1					1													2
silica						1								1		1	1	2		2		1												2		11
silver					2							1				1								1												5
Soda Ash											1																									1
sodium													1									1			1									1		4
sodium																		1																		1
sodium hydroxide					2									1		1		1	1			1	2													9
solvents																		1					2													3
stoddard solvent	1	1			3							1				3	1	3			1		3				1									18
Sulfuric Acid					1	1								1			1	3	1				3				1									12
TCE					6	1							2	1		2	2	5				2	3		1									2		27
Turco 4502											3		1						2																	6
turco 4518					1																															1
turco 4527					1																															1
turco solvent					1																															1
turco xx					1											2							1													4
Uranium																	1																			1
welding fumes																	1	3				6												11		21
x-ray chemicals																								1												1
Zinc Bromide																1		1				1														3
Zirconium																	2																			2
(blank)																																				
Grand Total	3	1	3	2	82	24	1	8	10	1	28	14	32	33	5	58	40	138	43	14	1	69	68	6	8	2	15	1	1	1	5	3	1	64		785

Job Titles vs. Chemical/Agent
(CFA Risk Map Data)

Chemical/	body men	bus drivers	carpenters	custodian	electrician	equipment operator	insulators	laborer	machinist	mechanic	painter	parts men	pipefitter	supervisor	welder		Grand Total
cutting fluid									1								1
Acetone									1		1						2
alcohol									1								1
arsenic									1								1
Asbestos			1		1		1	1	1	2	1		1	1	1		11
brazing flux										1							1
cadmium									1								1
carbon monoxide										1							1
Carbon Tet.									1		1						2
Chromium									1								1
contact cement			1														1
copper					1				1								2
cutting oils										1			1				2
epoxy											1						1
ethylene glycol										1							1
External Radiation									1						2		3
freon										1							1
HCl										1			1				2
herbicides								1									1
Internal Radiation															2		2
Lead	1					1		1	2	3	1		1		1		11
lead fumes						1		1							1		3
lifting hazard										2							2
motor oil										1							1
nickel									1								1
Nitric Acid									1								1
noise			1	1		1		3	1	1					1		9

Job Titles vs. Chemical/Agent
(CFA Risk Map Data)

Chemical/	body men	bus drivers	carpenters	custodian	electrician	equipment operator	insulators	laborer	machinist	mechanic	painter	parts men	pipefitter	supervisor	welder		Grand Total
paint stripper	1									1							2
paint thinner											1						1
PCBs					1												1
pesticides								1									1
silica										1	1						2
stoddard solvent	1	1								1		1					4
Sulfuric Acid										1							1
TCE									1	1							2
welding fumes										1							1
Zirconium									1								1
Grand Total	3	1	3	1	3	3	1	8	17	21	7	1	4	1	8		82

Job Titles vs. Chemical/Agent
(CPP Risk Map Data)

Chemical/	electrician	Helper	HP Techs	Instrument Tech	machinist	mechanic	Operator	pipefitter	welder	Grand Total
Acetone									1	1
Ammon. Hydrox.							1			1
Asbestos				1		2	2	2	1	8
Boric Acid		1								1
cadmium Sulfate		1								1
Carbon Tet.				1						1
Chromic Acid		1								1
cutting oils					1					1
External Radiation	1	9	5	6		7	13	3	3	47
Gadalidium Oxide							1			1
Heat			1			1	1	2	1	6
Hexone		2					2			4
HF		2	1	3		3	2			11
Internal Radiation	1	5	4	5		4	9	2	2	32
Lead					1					1
Lead Solder				1						1
Mercuric Nitrate		1								1
Mercury				2						2
MIBK				1		1	1			3
NaK			1			1	1	2	1	6
Nitric Acid	1	2	1	2		2	5	3	3	19
noise			1			1	1	1		4
Soda Ash		1								1
sodium hydroxide				1		1	1			3
Sulfuric Acid				1		1	1			3
TCE				1						1
Turco 4502		3	1				2			6
Uranium					1					1

Job Titles vs. Chemical/Agent
(CPP Risk Map Data)

Chemical/	electrician	Helper	HP Techs	Instrument Tech	machinist	mechanic	Operator	pipefitter	welder	Grand Total
welding fumes									1	1
Zirconium					1					1
Grand Total	3	28	15	25	4	24	43	15	13	170

Job Titles vs. Chemical/Agent
(TAN Risk Map Data)

Chemical/	Decon Techs	electrician	equipment operator	Experimental Machinist	Hot Cell Techs	Instrument Tech	laborer	mechanic	painter	pipefitter	quality assurance	sheet metal worker	technician	tool crib attendent	welder	Grand Total
Acetic Acid	2				1											3
Acetone	5	2			1	1	4	3		4			1	1	2	24
alcohol	2	1			1		1	1		1				1	1	9
arc flashes								1		1					1	3
Asbestos	1	1												1		3
Benzene	1															1
Beryllium	1		1	2	1		1	1								7
cadmium	2				1		1									4
Chromium				1			1	1	1	2					1	7
copper	1	1		1	1		1									5
cutting oils				1												1
External Radiation	9	1		1			3	5	1	3	1		1		2	27
freon						1										1
gold	2				1		1									4
granulated slag							1		1							2
halfnium	2				1		1									4
HCl	1															1
Heat	4	1			1		2	2		2			1		1	14
HF	3															3
Internal Radiation	8			1			2	3	1	1					1	17
iron oxide											1					1
Lead	5	1		1	1		4	5	1	2	1		1		3	25
maga glow											1					1
Mercury	2					1										3
Methylene Chloride	4	1					3	2		2			1		1	14

Job Titles vs. Chemical/Agent
(TAN Risk Map Data)

Chemical/	Decon Techs	electrician	equipment operator	Experimental Machinist	Hot Cell Techs	Instrument Tech	laborer	mechanic	painter	pipefitter	quality assurance	sheet metal worker	technician	tool crib attendent	welder	Grand Total
nickel	2			1	1		1									5
Nitric Acid	4				1			1		1						7
noise	1	2		1		1	1	2		4		1			4	17
PCBs		1														1
perchloroethylene	1						1									2
platinum	1															1
silica		1				1	1	1	1	1					1	7
silver	2				1		1				1					5
sodium hydroxide	2						1									3
stoddard solvent	3				1		2									6
Sulfuric Acid	1															1
TCE	6	1					2	2		2					1	14
turco 4518	1															1
turco 4527	1															1
turco solvent	1															1
turco xx	1															1
welding fumes								1		4					4	9
x-ray chemicals											1					1
Zinc Bromide							1	1		1						3
Grand Total	82	14	1	10	14	5	37	32	6	31	6	1	5	3	23	270

Job Titles vs. Chemical/Agent
(TRA Risk Map Data)

Chemical/	custodian	electrician	EPROs	equipment operator	foreman	HP Techs	Instrument Tech	insulators	laborer	machinist	mechanic	painter	pipefitter	process operator	reactor engineer	Reactor Instrument Tech	Reactor operator	sponser engineer	utility operator	welder	Grand Total
Acetic Acid																	1				1
Acetone						2			1	1	3					1				1	9
acid									1		1			1			1				4
Asbestos	1				1			1	1	1	3	1	2	2	1					1	15
Beryllium				3		1				1	4		2	3	1		2				17
cadmium										1				2	1						4
Carbon Tet.									1		1			2			1				5
ceramics										1											1
chlorine														1							1
chromium										1											1
citric acid																	1				1
copper										1											1
downal														1							1
ethanol										1											1
External Radiation		1	1	1		4	1	1		1	14		5	16	1		2			4	52
Heat		1				1	1	1			1		1	1						1	8
Internal Radiation		1				3	1	1		1	7		2	7	1			1	1	2	28
IPA											2					1					3
Lead						2			5	1	9		2	5			1			1	26
Mercury									1					2	1						4
nickel										1	1		1							1	4
Nitric Acid										1	1			3			2				7
noise						1				1	5			7			2				16
powdered lead											1			1							2
silica										1										1	2

Job Titles vs. Chemical/Agent
(TRA Risk Map Data)

Chemical/	custodian	electrician	EPROs	equipment operator	foreman	HP Techs	Instrument Tech	insulators	laborer	machinist	mechanic	painter	pipefitter	process operator	reactor engineer	Reactor Instrument Tech	Reactor operator	sponser engineer	utility operator	welder	Grand Total
sodium						1							1		1					1	4
sodium											1										1
sodium hydroxide													1	2							3
solvents											1			2							3
stoddard solvent									1	1	2			3			1				8
Sulfuric Acid		1								1	1			3			1				7
TCE						2				1	2			3	1					1	10
turco xx									2					1							3
welding fumes										1	1		2							6	10
Grand Total	1	4	1	4	1	17	3	4	13	19	61	1	19	68	8	2	15	1	1	20	263

Appendix B2:

Risk Map Exposures for CFA Buildings

Job Titles vs. Chemical/Agent
(CFA Bldg. 640 Risk Map Data)

Chemical/	custodian	machinist	Grand Total
cutting fluid		1	1
Acetone		1	1
alcohol		1	1
arsenic		1	1
Asbestos		1	1
cadmium		1	1
Carbon Tet.		1	1
Chromium		1	1
copper		1	1
External Radiation		1	1
Lead		2	2
nickel		1	1
Nitric Acid		1	1
noise	1	1	2
TCE		1	1
Zirconium		1	1
Grand Total	1	17	18

Job Titles vs. Chemical/Agent
(CFA Bldg. 649 Risk Map Data)

Facility CFA

Chemical/	equipment operator	laborer	welder	Grand Total
Asbestos			1	1
External Radiation			2	2
Internal Radiation			2	2
Lead	1	1	1	3
lead fumes	1	1	1	3
noise	1	1	1	3
Grand Total	3	3	8	14

Job Titles vs. Chemical/Agent
(CFA Bldg. 654 Risk Map Data)

Facility	CFA								
Bldg	654								
Count of Exp	Job								
Chemical/	carpenters	electrician	insulators	laborer	mechanic	painter	pipefitter	supervisor	Grand Total
Acetone						1			1
Asbestos	1	1	1	1	1	1	1	1	8
Carbon Tet.						1			1
contact cement	1								1
copper		1							1
cutting oils					1				1
epoxy						1	1		2
freon					1				1
HCl					1				1
herbicides				1			1		2
Lead						1			1
noise	1						1		2
paint thinner				2		1			3
PCBs		1							1
pesticides				1					1
silica						1			1
Grand Total	3	3	1	5	4	7	4	1	28

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Job Titles vs. Chemical/Agent
(CFA Bldg. 665 Risk Map Data)

Facility	CFA				
Bldg	665				
Count of Exp	Job				
Chemical/	body men	bus drivers	mechanic	parts men	Grand Total
Asbestos			1		1
brazing flux			1		1
carbon monoxide			1		1
ethylene glycol			1		1
Lead			1		1
lifting hazard	1		3		4
motor oil			2		2
noise			1		1
paint stripper			1		1
silica	1		1		2
stoddard solvent			1		1
Sulfuric Acid	1	1	1	1	4
TCE			1		1
welding fumes			1		1
Grand Total	3	1	17	1	22

Appendix B3:

Risk Map Exposures for CPP Buildings

Job Titles vs. Chemical/Agent
(CPP Bldg. 601 Risk Map Data)

Facility	CPP						
Bldg	601						
Count of Exp	Job						
Chemical/	Helper	HP Techs	Instrument Tech	mechanic	Operator	pipefitter	Grand Total
Ammon. Hydrox.					1		1
Asbestos			1	2	1	1	5
Boric Acid	1						1
cadmium Sulfate	1						1
Chromic Acid	1						1
External Radiation	6	2	4	6	7		25
Gadalidium Oxide					1		1
Hexone	1				1		2
HF	2	1	3	3	2		11
Internal Radiation	3	2	3	3	6		17
Mercuric Nitrate	1						1
MIBK			1	1	1		3
Nitric Acid	1		1	2	2		6
Soda Ash	1						1
sodium hydroxide			1	1	1		3
Sulfuric Acid			1	1	1		3
Turco 4502	2				1		3
Grand Total	20	5	15	19	25	1	85

Job Titles vs. Chemical/Agent
(CPP Bldg. 630 Risk Map Data)

Facility	CPP			
Bldg	630			
Count of Exp	Job			
Chemical/	Instrument Tech	machinist	welder	Grand Total
Acetone			1	1
cutting oils		1		1
Lead		1		1
Mercury	1			1
TCE	1			1
Uranium		1		1
welding fumes			1	1
Zirconium		1		1
Grand Total	2	4	2	8

Job Titles vs. Chemical/Agent
(CPP Bldg. 633 Risk Map Data)

Chemical/	electrician	HP Techs	Instrument Tech	mechanic	Operator	pipefitter	welder	Grand Total
Asbestos					1	1	1	3
External Radiation	1	2	1	1	2	3	3	13
Heat		1		1	1	2	1	6
Internal Radiation	1	1	1	1	1	2	2	9
NaK		1		1	1	2	1	6
Nitric Acid	1	1	1		2	3	3	11
noise		1		1	1	1		4
Grand Total	3	7	3	5	9	14	11	52

Job Titles vs. Chemical/Agent
(CPP Bldg. 601 Risk Map Data)

Facility	CPP				
Bldg	601				
Count of Exp	Job				
Chemical/	Helper	HP Techs	Instrument Tech	Operator	Grand Total
External Radiation	2	1	1	3	7
Hexone	1			1	2
Internal Radiation	1	1	1	1	4
Nitric Acid	1			1	2
Turco 4502	1	1		1	3
Grand Total	6	3	2	7	18

Job Titles vs. Chemical/Agent
(CPP Bldg. 602 Risk Map Data)

Facility	CPP			
Bldg	602			
Count of Exp	Job			
Chemical/	Helper	Instrument Tech	Operator	Grand Total
Carbon Tet.		1		1
External Radiation	1		1	2
Internal Radiation	1		1	2
Lead Solder		1		1
Mercury		1		1
Grand Total	2	3	2	7

Appendix B4:

Risk Map Exposures for TRA Buildings

Job Titles vs. Chemical/Agent
(TRA Bldg. 603 Risk Map Data)

Chemical/	EPROs	equipment operator	HP Techs	insulators	laborer	mechanic	pipefitter	process operator	Reactor operator	welder	Grand Total
acid					1	1		1	1		4
Asbestos				1		1	1	1			4
Beryllium		1				2		2			5
cadmium								1			1
Carbon Tet.					1	1		2	1		5
External Radiation	1	1	1			4	1	8		1	17
Internal Radiation						2		3			5
Lead					2	2	1	2			7
Mercury					1			1			2
Nitric Acid								1			1
noise						1		1			2
solvents						1		2			3
stoddard solvent					1	1		2	1		5
welding fumes							1			1	2
Grand Total	1	2	1	1	6	16	4	27	3	2	63

Job Titles vs. Chemical/Agent
(TRA Bldg. 642 Risk Map Data)

Facility

Chemical/	electrician	HP Techs	Instrument Tech	insulators	mechanic	pipefitter	process operator	reactor engineer	sponser engineer	utility operator	welder	Grand Total
Acetone		1										1
Asbestos					1	1	1	1				4
Beryllium		1					1	1				3
cadmium							1	1				2
chlorine							1					1
downal							1					1
External Radiation	1	2	1	1	3	1	3	1			1	14
Heat	1	1	1	1	1	1	1				1	8
Internal Radiation	1	3	1	1	3	2	3	1	1	1	1	18
Lead		1			3		3				1	8
Mercury							1	1				2
nickel					1	1					1	3
Nitric Acid							1					1
noise					1		1					2
powdered lead					1		1					2
sodium		1				1		1			1	4
sodium					1							1
sodium hydroxide						1	1					2
stoddard solvent							1					1
Sulfuric Acid	1				1		2					4
TCE		1			1		3	1				6
turco xx							1					1
welding fumes					1	1					1	3
Grand Total	4	11	3	3	18	9	27	8	1	1	7	92

Job Titles vs. Chemical/Agent
(TRA Bldg. 653 Risk Map Data)

Chemical/	custodian	foreman	laborer	machinist	mechanic	painter	welder	Grand Total
Acetone			1	1				2
Asbestos	1	1	1	1	1	1	1	7
Beryllium				1				1
cadmium				1				1
ceramics				1				1
chromium				1				1
copper				1				1
ethanol				1				1
External Radiation				1				1
Internal Radiation				1				1
Lead			1	1				2
nickel				1				1
Nitric Acid				1				1
noise				1				1
silica				1				1
stoddard solvent				1			1	2
Sulfuric Acid				1	1			2
TCE				1				1
welding fumes				1			1	2
Grand Total	1	1	3	19	2	1	3	30

Job Titles vs. Chemical/Agent
(TRA Bldg. 670 Risk Map Data)

Chemical/	equipment operator	HP Techs	laborer	mechanic	pipefitter	process operator	Reactor Instrument Tech	Reactor operator	welder	Grand Total
Acetic Acid								1		1
Acetone		1		3			1		1	6
Beryllium	2			2	2			2		8
citric acid								1		1
External Radiation		1		7	3	5		2	2	20
Internal Radiation				2		1			1	4
IPA				2			1			3
Lead		1	2	4	1			1		9
Nitric Acid				1		1		2		4
noise		1		3		5		2		11
sodium hydroxide						1				1
Sulfuric Acid						1		1		2
TCE		1		1					1	3
turco xx			2							2
welding fumes									3	3
Grand Total	2	5	4	25	6	14	2	12	8	78

Appendix B5:

Risk Map Exposures for TAN Buildings

Job Titles vs. Chemical/Agent
(TAN Bldg. 607 Risk Map Data)

Chemical/	Decon Techs	electrician	equipment operator	Experimental Machinist	Hot Cell Techs	Instrument Tech	laborer	mechanic	painter	pipefitter	quality assurance	sheet metal worker	technician	tool crib attendent	welder	Grand Total
Acetic Acid	2				1											3
Acetone	4	2			1	1	4	3		4			1	1	2	23
alcohol	1	1			1		1	1		1				1	1	8
arc flashes								1		1					1	3
Asbestos	1	1												1		3
Benzene	1															1
Beryllium	1		1	2	1		1	1								7
cadmium	1				1		1									3
Chromium				1			1	1	1	2					1	7
copper	1	1		1	1		1									5
cutting oils				1												1
External Radiation	5	1		1			3	5	1	3	1		1		2	23
freon						1										1
gold	1				1		1									3
granulated slag							1		1							2
halfnium	1				1		1									3
HCl	1															1
Heat	4	1			1		2	2		2			1		1	14
HF	2															2
Internal Radiation	4			1			2	3	1	1					1	13
iron oxide											1					1
Lead	4	1		1	1		4	5	1	2	1		1		3	24
maga glow											1					1
Mercury	1					1										2
Methylene Chloride	3	1					3	2		2			1		1	13

Job Titles vs. Chemical/Agent
(TAN Bldg. 607 Risk Map Data)

Chemical/	Decon Techs	electrician	equipment operator	Experimental Machinist	Hot Cell Techs	Instrument Tech	laborer	mechanic	painter	pipefitter	quality assurance	sheet metal worker	technician	tool crib attendent	welder	Grand Total
nickel	1			1	1		1									4
Nitric Acid	3				1			1		1						6
noise	1	2		1		1	1	2		4		1			4	17
PCBs		1														1
perchloroethylene	1						1									2
silica		1				1	1	1	1	1					1	7
silver	1				1		1				1					4
sodium hydroxide	1						1									2
stoddard solvent	2				1		2									5
TCE	5	1					2	2		2					1	13
turco 4518	1															1
turco 4527	1															1
turco solvent	1															1
turco xx	1															1
welding fumes								1		4					4	9
x-ray chemicals											1					1
Zinc Bromide							1	1		1						3
Grand Total	57	14	1	10	14	5	37	32	6	31	6	1	5	3	23	245

Job Titles vs. Chemical/Agent
(TAN Bldg. 633 Risk Map Data)

Facility	TAN	
Bldg	633	
Count of Exp	Job	
Chemical/	Decon Techs	Grand Total
Acetone	1	1
alcohol	1	1
cadmium	1	1
External Radiation	4	4
gold	1	1
halfnium	1	1
HF	1	1
Internal Radiation	4	4
Lead	1	1
Mercury	1	1
Methylene Chloride	1	1
nickel	1	1
Nitric Acid	1	1
platinum	1	1
silver	1	1
sodium hydroxide	1	1
stoddard solvent	1	1
Sulfuric Acid	1	1
TCE	1	1
Grand Total	25	25

Appendix C:

High Exposure Ranking Matrix

(Job Classification / Chemical)

High Exposure Ranking
(CFA, CPP, TRA, and TAN Risk Map Data)

Chemical/	body men	carpenters	custodian	Decon Techs	electrician	EPROs	equipment operator	Experimental Machinist	Helper	Hot Cell Techs	HP Techs	Instrument Tech	insulators	laborer	machinist	mechanic	Operator	painter	pipefitter	process operator	quality assurance	reactor engineer	Reactor operator	technician	welder	(blank)	Grand Total
Acetone				2										2		1		1	1						1		8
acid														1		1				1			1				4
Ammonium Hydroxide																	1										1
asbestos												1	1			3	1		2								8
Beryllium							1	1								2				1							5
carbon monoxide																1											1
carbon tetrachloride												1		1		1		1		2			1				7
Chromic Acid									1																		1
chromium								1							1												2
External Radiation				4	3	1			4		3	3	1	2		11	3		6	8	1	1			5		56
Gadalidium Oxide																	1										1
granulated slag														1				1									2
heat				4	2					1	1	1	1	2		3			4	1				1	3		24
herbicides														1													1
HF									2		1	2				2	1										8
Internal Radiation				2	2				2		3	3	1	1		5	3		4	3					4		33
Lead	1			1										7	2	6			1	3					3		24
lead fumes																									1		1
Mercuric Nitrate									1																		1
Mercury				1								1															2
Methylene Chloride				3										2		1			1								7
NaK																			1						1		2
nickel															1												1
Nitric Acid				1	1				1		1						1		3						3		11
noise		1	1					1							2	3				3					3		14

High Exposure Ranking
(CFA, CPP, TRA, and TAN Risk Map Data)

Chemical/	body men	carpenters	custodian	Decon Techs	electrician	EPROs	equipment operator	Experimental Machinist	Helper	Hot Cell Techs	HP Techs	Instrument Tech	insulators	laborer	machinist	mechanic	Operator	painter	pipefitter	process operator	quality assurance	reactor engineer	Reactor operator	technician	welder	(blank)	Grand Total
paint stripper	1																										1
paint thinner																		1									1
perchloroethylene				1										1													2
pesticides														1													1
silica														1				2									3
Soda Ash									1																		1
sodium hydroxide				1										1													2
solvents																1				1							2
stoddard solvent				1										2		1				2			1				7
TCE				4	1									2		1			1	1		1			1		12
Turco 4502									3		1						2										6
turco 4518				1																							1
turco 4527				1																							1
turco solvent				1																							1
turco xx				1																							1
welding fumes															1	1			3						7		12
Zinc Bromide														1		1			1								3
(blank)																											
Grand Total	2	1	1	29	9	1	1	3	15	1	10	12	4	29	7	45	13	6	28	26	1	2	3	1	32		282

High Exposure Ranking
(CFA Risk Map Data)

Chemical/	body men	carpenters	custodian	insulators	laborer	machinist	mechanic	painter	pipefitter	welder	Grand Total
Acetone								1			1
asbestos				1			1		1		3
carbon monoxide							1				1
carbon tetrachloride								1			1
chromium						1					1
herbicides					1						1
Lead	1									1	2
lead fumes										1	1
nickel						1					1
noise		1	1			1				1	4
paint stripper	1										1
paint thinner								1			1
pesticides					1						1
silica								1			1
Grand Total	2	1	1	1	2	3	2	4	1	3	20

High Exposure Ranking
(CPP Risk Map Data)

Facility

Chemical/	electrician	Helper	HP Techs	Instrument Tech	machinist	mechanic	Operator	pipefitter	welder	Grand Total
Acetone									1	1
Ammonium Hydroxide							1			1
asbestos				1		2	1	1		5
carbon tetrachloride				1						1
Chromic Acid		1								1
External Radiation	1	4	2	2		3	3	2	2	19
Gadalidium Oxide							1			1
heat								1	1	2
HF		2	1	2		2	1			8
Internal Radiation	1	2	2	2		1	3	2	2	15
Lead					1					1
Mercuric Nitrate		1								1
Mercury				1						1
NaK								1	1	2
Nitric Acid	1	1	1				1	3	3	10
Soda Ash		1								1
Turco 4502		3	1				2			6
welding fumes									1	1
Grand Total	3	15	7	9	1	8	13	10	11	77

High Exposure Ranking
(TRA Risk Map Data)

Facility	TRA														
Bldg	(All)														
Chemical/	electrician	EPROs	equipment operator	HP Techs	Instrument Tech	insulators	laborer	machinist	mechanic	pipefitter	process operator	reactor engineer	Reactor operator	welder	Grand Total
acid							1		1		1		1		4
Beryllium			1						2		1				4
carbon tetrachloride							1		1		2		1		5
External Radiation	1	1		1	1	1			5	2	8	1		2	23
heat	1			1	1	1			1	1	1			1	8
Internal Radiation	1			1	1	1			2	1	3			1	11
Lead							5	1	5	1	3			1	16
noise								1	3		3				7
solvents									1		1				2
stoddard solvent							1		1		2		1		5
TCE											1	1			2
welding fumes								1	1	1				2	5
Grand Total	3	1	1	3	3	3	8	3	23	6	26	2	3	7	92

High Exposure Ranking
(TAN Risk Map Data)

Chemical/	Decon Techs	electrician	Experimental Machinist	Hot Cell Techs	laborer	mechanic	painter	pipefitter	quality assurance	technician	welder	Grand Total
Acetone	2				2	1		1				6
Beryllium			1									1
chromium			1									1
External Radiation	4	1			2	3		2	1		1	14
granulated slag					1		1					2
heat	4	1		1	2	2		2		1	1	14
Internal Radiation	2				1	2		1			1	7
Lead	1				2	1					1	5
Mercury	1											1
Methylene Chloride	3				2	1		1				7
Nitric Acid	1											1
noise			1								2	3
perchloroethylene	1				1							2
silica					1		1					2
sodium hydroxide	1				1							2
stoddard solvent	1				1							2
TCE	4	1			2	1		1			1	10
turco 4518	1											1
turco 4527	1											1
turco solvent	1											1
turco xx	1											1
welding fumes								2			4	6
Zinc Bromide					1	1		1				3
Grand Total	29	3	3	1	19	12	2	11	1	1	11	93

Appendix D:

Average Dose Factor Matrix

(Job Classification / Chemical)

Table 1. Average Dose Factor (All Facilities – CFA, CPP, TRA, TAN)
Table 2. Average Dose Factor (CFA)
Table 3. Average Dose Factor (CPP)
Table 4. Average Dose Factor (TRA)
Table 5. Average Dose Factor (TAN)

Average Dose Factor by Job Title
(CFA, CPP, TRA, and TAN Risk Map Data)

Chemical/	body men	bus drivers	carpenters	custodian	Decon Techs	electrician	EPROs	equipment operator	Experimental Machinist	foreman	Helper	Hot Cell Techs	HP Techs	Instrument Tech	insulators	laborer	machinist	mechanic	Operator	painter	parts men	pipefitter	process operator	quality assurance	reactor engineer	Reactor Instrument Tech	Reactor operator	sheet metal worker	sponser engineer	supervisor	technician	tool crib attendent	utility operator	welder	(blank)	Grand Total
"chemtool" cutting fluid																	8																			8
Acetic Acid					6							2															2									4
Acetone					35	6						2	2	10		11	2	6		80		11				2					10	10		9		13
acid																20		20					20				20									20
alcohol					2	2						2				2		2				2										10		2		3
alcohol																	2																			2
Ammonium Hydroxide																			0																	0
arc flashes																		10				10												10		10
arsenic																	2																			2
asbestos			8	2	10	5				2				20	41	5	5	10	15	5		22	1		0					8		2		7		11
Benzene					2																															2
Beryllium					2			16	15			2	2			2	2	18				21	8		2		21									13
Boric Acid											10																									10
brazing flux																		2																		2
cadmium					6							2				2	2						2		2											3
cadmium Sulfate											40																									40
carbon monoxide																		20																		20
carbon tetrachloride														80		20	2	20		80			20				20									33
ceramics																	2																			2
chlorine																							2													2
Chromic Acid											80																									80
Chromium									20							10	80	10		10		8												40		23
chromium																	2																			2
citric acid																											2									2
contact cement			10																																	10
copper					2	21			2			2				2	2																			7
cutting oils									40								40	40				40														40
downal																							1													1
epoxy																				2																2
ethanol																	2																			2
ethylene glycol																		40																		40
External Radiation					29	20	20	10	2		26		18	10	20	14	25	16	13	2		18	24	80	40		2				2			20		19
freon														10				2																		6
Gadalidium Oxide																			20																	20

Average Dose Factor by Job Title
(CFA, CPP, TRA, and TAN Risk Map Data)

Chemical/	body men	bus drivers	carpenters	custodian	Decon Techs	electrician	EPROs	equipment operator	Experimental Machinist	foreman	Helper	Hot Cell Techs
gold					6							2
granulated slag												
halfnium					6							2
HCl					10							
heat					65	20						20
herbicides												
Hexone											11	
HF					7						30	
Internal Radiation					8	20			2		9	
IPA												
iron oxide												
Lead	80				9	10		2	2			2
lead fumes								2				
Lead Solder												
lifting hazard												
maga glow												
Mercuric Nitrate											80	
mercury					15							
Methylene Chloride					46	10						
MIBK												
motor oil												
NaK												
nickel					6				10			2
Nitric Acid					9	20					15	2
noise			80	80	8	21		2	80			
paint stripper	80											
paint thinner												
PCBs						2						
perchloroethylene					80							
pesticides												
platinum					10							

Chemical/	HP Techs	Instrument Tech	insulators	laborer	machinist	mechanic	Operator	painter	parts men	pipefitter	process operator
gold				2							
granulated slag				80				80			
halfnium				2							
HCl						10				10	
heat	11	20	20	50		31	2			28	20
herbicides				20							
Hexone							11				
HF	20	23				23	15				
Internal Radiation	22	12	20	11	10	18	13	2		30	12
IPA						1					
iron oxide											
Lead	2			34	11	20		9		10	13
lead fumes				10							
Lead Solder		40									
lifting hazard						10					
maga glow											
Mercuric Nitrate											
mercury		41		10							6
Methylene Chloride				37		15				15	
MIBK		10				10	10				
motor oil						40					
NaK	0					0	0			10	
nickel				2	45	2				2	
Nitric Acid	20	10			6	6	18			16	1
noise	2	40		16	80	26	2			20	29
paint stripper						2					
paint thinner								80			
PCBs											
perchloroethylene				20							
pesticides				20							
platinum											

Chemical/	quality assurance	reactor engineer	Reactor Instrument Tech	Reactor operator	sheet metal worker	sponser engineer	supervisor	technician	tool crib attendent	utility operator	welder	(blank)	Grand Total
gold													4
granulated slag													80
halfnium													4
HCl													10
heat								80			40		35
herbicides													20
Hexone													11
HF													19
Internal Radiation		10				10				10	26		16
IPA			2										2
iron oxide	10												10
Lead	8			8				10			28		18
lead fumes											80		31
Lead Solder													40
lifting hazard													10
maga glow	10												10
Mercuric Nitrate													80
mercury		2											20
Methylene Chloride								10			10		27
MIBK													10
motor oil													40
NaK											20		7
nickel											2		12
Nitric Acid				2							20		11
noise				2	10						64		31
paint stripper													41
paint thinner													80
PCBs													2
perchloroethylene													50
pesticides													20
platinum													10

Average Dose Factor by Job Title
(CFA, CPP, TRA, and TAN Risk Map Data)

Chemical/	body men	bus drivers	carpenters	custodian	Decon Techs	electrician	EPROs	equipment operator	Experimental Machinist	foreman	Helper	Hot Cell Techs	HP Techs	Instrument Tech	insulators	laborer	machinist	mechanic	Operator	painter	parts men	pipefitter	process operator	quality assurance	reactor engineer	Reactor Instrument Tech	Reactor operator	sheet metal worker	sponser engineer	supervisor	technician	tool crib attendent	utility operator	welder	(blank)	Grand Total
powdered lead																		2					2													2
silica						2								2		20	10	2		50		2												6		14
silver					6							2				2								10												5
Soda Ash											80																									80
sodium													1									1			1									1		1
sodium																		1																		1
sodium hydroxide					45									10		20		10	10			1	2													16
solvents																		80					41													54
stoddard solvent	2	2			28							2				14	2	23			2		13				20									15
sulfuric acid					10	0								10			2	17	10				1				2									8
TCE					44	20							1	40		20	21	6				11	10		20									11		20
Turco 4502											7		20						11																	11
turco 4518					20																															20
turco 4527					20																															20
turco solvent					20																															20
Turco xx					80											4							1													22
Uranium																	0																			0
welding fumes																	20	23				39												37		35
x-ray chemicals																								10												10
Zinc Bromide																20		20				20														20
Zirconium																	1																			1
(blank)																																				
Grand Total	54	2	33	41	23	13	20	10	19	2	25	3	13	20	28	19	15	17	12	33	2	19	15	21	10	2	8	10	10	8	22	7	10	27		18

Average Dose Factor by Job Title
(CFA Risk Map Data)

Chemical/	body men	bus drivers	carpenters	custodian	electrician	equipment operator	insulators	laborer	machinist	mechanic	painter	parts men	pipefitter	supervisor	welder	Grand Total
"chemtool" cutting fluid									8							8
Acetone									2		80					41
alcohol									2							2
arsenic									2							2
asbestos			8		8		80	8	8	14	8		80	8	8	22
brazing flux										2						2
cadmium									2							2
carbon monoxide										20						20
carbon tetrachloride									2		80					41
Chromium									80							80
contact cement			10													10
copper					40				2							21
cutting oils										40			40			40
epoxy											2					2
ethylene glycol										40						40
External Radiation									40						2	15
freon										2						2
HCl										10			10			10
herbicides								20								20
Internal Radiation															2	2
Lead	80					2		10	2	15	8		10		80	22
lead fumes						2		10							80	31
lifting hazard										10						10
motor oil										40						40

Average Dose Factor by Job Title
(CFA Risk Map Data)

Chemical/	body men	bus drivers	carpenters	custodian	electrician	equipment operator	insulators	laborer	machinist	mechanic	painter	parts men	pipefitter	supervisor	welder	Grand Total
nickel									80							80
Nitric Acid									10							10
noise			80	80		2		20	80	20					80	45
paint stripper	80									2						41
paint thinner											80					80
PCBs					2											2
pesticides								20								20
silica										2	20					11
stoddard solvent	2	2								40		2				12
sulfuric acid										40						40
TCE									2	5						4
welding fumes										10						10
Zirconium									2							2
Grand Total	54	2	33	80	17	2	80	16	19	17	40	2	35	8	32	24

Average Dose Factor by Job Title
(CPP Risk Map Data)

Chemical/	electrician	Helper	HP Techs	Instrument Tech	machinist	mechanic	Operator	pipefitter	welder	Grand Total
Acetone									20	20
Ammonium Hydroxide							0			0
asbestos				20		20	15	15	10	16
Boric Acid		10								10
cadmium Sulfate		40								40
carbon tetrachloride				80						80
Chromic Acid		80								80
cutting oils					40					40
External Radiation	20	26	26	9		13	13	17	17	17
Gadalidium Oxide							20			20
heat			2			2	2	11	20	8
Hexone		11					11			11
HF		30	20	23		23	15			23
Internal Radiation	20	9	30	10		13	13	20	20	15
Lead					20					20
Lead Solder				40						40
Mercuric Nitrate		80								80
mercury				60						60
MIBK				10		10	10			10
NaK			0			0	0	10	20	7
Nitric Acid	20	15	20	10		10	18	20	20	17
noise			2			2	2	2		2
Soda Ash		80								80
sodium hydroxide				10		10	10			10

Average Dose Factor by Job Title
(CPP Risk Map Data)

Chemical/	electrician	Helper	HP Techs	Instrument Tech	machinist	mechanic	Operator	pipefitter	welder	Grand Total
sulfuric acid				10		10	10			10
TCE				40						40
Turco 4502		7	20				11			11
Uranium					0					0
welding fumes									20	20
Zirconium					0					0
Grand Total	20	25	21	21	15	13	12	15	18	17

Average Dose Factor by Job Title
(TRA Risk Map Data)

Facility	TRA																				
Chemical/	custodian	electrician	EPROs	equipment operator	foreman	HP Techs	Instrument Tech	insulators	laborer	machinist	mechanic	painter	pipefitter	process operator	reactor engineer	Reactor Instrument Tech	Reactor operator	sponser engineer	utility operator	welder	Grand Total
Acetic Acid																	2				2
Acetone						2			2	2	2					2				2	2
acid									20		20			20			20				20
asbestos	2				2			2	2	2	1	2	1	1	0					2	2
Beryllium				21		2				2	21		21	8	2		21				15
cadmium										2				2	2						2
carbon tetrachloride									20		20			20			20				20
ceramics										2											2
chlorine														2							2
chromium										2											2
citric acid																	2				2
copper										2											2
downal														1							1
ethanol										2											2
External Radiation		20	20	10		9	20	20		10	15		9	24	40		2			21	17
heat		20				20	20	20			20		20	20						20	20
Internal Radiation		20				11	20	20		10	14		15	12	10			10	10	30	14
IPA											1					2					2
Lead						2			44	20	25		11	13			8			20	23
mercury									10					6	2						6
nickel										10	2		2							2	4

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Average Dose Factor by Job Title
(TRA Risk Map Data)

Chemical/	custodian	electrician	EPROs	equipment operator	foreman	HP Techs	Instrument Tech	insulators	laborer	machinist	mechanic	painter	pipefitter	process operator	reactor engineer	Reactor Instrument Tech	Reactor operator	sponser engineer	utility operator	welder	Grand Total
Nitric Acid										2	2			1			2				2
noise						2				80	35			29			2				29
powdered lead											2			2							2
silica										10										10	10
sodium						1							1		1					1	1
sodium											1										1
sodium hydroxide													1	2							1
solvents											80			41							54
stoddard solvent									20	2	15			13			20				14
sulfuric acid		0								2	2			1			2				2
TCE						1				40	1			10	20					2	10
Turco xx									4					1							3
welding fumes										20	20		11							11	13
Grand Total	2	15	20	18	2	6	20	16	23	12	17	2	10	15	10	2	8	10	10	13	14

Average Dose Factor by Job Title
(TAN Risk Map Data)

Chemical/	Decon Techs	electrician	equipment operator	Experimental Machinist	Hot Cell Techs	Instrument Tech	laborer	mechanic	painter	pipefitter	quality assurance	sheet metal worker	technician	tool crib attendent	welder	Grand Total
Acetic Acid	6				2											5
Acetone	35	6			2	10	13	11		11			10	10	6	15
alcohol	2	2			2		2	2		2				10	2	3
arc flashes								10		10					10	10
asbestos	10	2												2		5
Benzene	2															2
Beryllium	2		2	15	2		2	10								7
cadmium	6				2		2									4
Chromium				20			10	10	10	8					40	15
copper	2	2		2	2		2									2
cutting oils				40												40
External Radiation	29	20		2			14	25	2	34	80		2		41	27
freon						10										10
gold	6				2		2									4
granulated slag							80		80							80
halfnium	6				2		2									4
HCl	10															10
heat	65	20			20		50	50		50			80		80	54
HF	7															7
Internal Radiation	8			2			11	34	2	80					80	21
iron oxide											10					10
Lead	9	10		2	2		28	12	10	10	8		10		13	13
maga glow											10					10

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09/09/1998

Average Dose Factor by Job Title
(TAN Risk Map Data)

Chemical/	Decon Techs	electrician	equipment operator	Experimental Machinist	Hot Cell Techs	Instrument Tech	laborer	mechanic	painter	pipefitter	quality assurance	sheet metal worker	technician	tool crib attendent	welder	Grand Total
mercury	15					2										11
Methylene Chloride	46	10					37	15		15			10		10	27
nickel	6			10	2		2									5
Nitric Acid	9				2			2		2						6
noise	8	21		80		40	2	21		25		10			60	33
PCBs		2														2
perchloroethylene	80						20									50
platinum	10															10
silica		2				2	20	2	80	2					2	16
silver	6				2		2				10					5
sodium hydroxide	45						20									37
stoddard solvent	28				2		11									18
sulfuric acid	10															10
TCE	44	20					20	11		11					20	28
turco 4518	20															20
turco 4527	20															20
turco solvent	20															20
Turco xx	80															80
welding fumes								40		53					80	63
x-ray chemicals											10					10
Zinc Bromide							20	20		20						20
Grand Total	23	10	2	19	3	13	19	19	31	24	21	10	22	7	41	21

Section VI

REPORT ON FOCUS GROUPS AT INEEL
JUNE, 1998

Susan O'Brien
New York Committee for Occupational Safety and Health

CONTENTS

1. INTRODUCTION

Focus Groups-Description

In phase I, former INEEL workers are participating in risk mapping sessions to collect qualitative exposure data to determine exposures associated with buildings, processes and job classifications. Former workers are also filling out questionnaires about prior exposures, job histories, health concerns and current health care. However, neither of these vehicles can answer the type of in-depth questions which are of tantamount importance in developing the best possible medical surveillance program. Therefore, focus group assessments of former workers were conducted in order to determine workers perceptions of their own and their co-workers occupational health risks, the desirability and expectations of medical surveillance and high risk notification and the accessibility and use of health care services for follow-up needs after the medical surveillance program. Focus groups, are group interviews comprised of 8-14 persons designed to gain an in-depth perspective on a narrow range of topics. Questions on the specific topic move from the general to the specific and in the group discussion which follows, a wide range of responses can be elicited. Focus groups are an excellent way to fill in the gaps left by the risk mapping and the questionnaires.

Worker-investigators (OSHEC's) conducted both the risk mapping and the focus group sessions. For the focus groups, a standardized moderator guide was developed with assistance from the OSHEC's who also received training on the methods for properly conducting a focus group. Instruction to them included how to set the tone for the group, how to facilitate, how to remain neutral and avoid leading questions and how to create a respectful atmosphere. While one OSHEC moderated the session, another acted as the scribe. It was particularly valuable to have the OSHEC's to moderate the focus groups. Their status as current workers and their expanded expertise in occupational safety and health and in training methodology greatly enhanced the discussions. They were extremely respected and credible and garnered a high degree of respect from the participants.

Focus group format

Two focus groups were held on June 22, 1998 at the OCAW union hall in Idaho Falls, Idaho which represents the workers at INEEL. Both groups, moderated by OSHEC Gaylon Hanson and scribed by Dan Koste were 1 ½ to 2 hours in length and in both sessions the moderator followed the standard moderator guide (see Appendix A). All participants received a participant information sheet and signed informed consent forms, read aloud to the group. Each signature was witnessed by Sylvia Kieding, OCAW Health and Safety Coordinator. The participants were assured that all aspects of their participation in the project would remain confidential. They were then asked to consent to the audio taping of the sessions. The tape was turned on after people introduced themselves and every effort was made to protect participants identities during the taping.

3. DEMOGRAPHIC MAKE-UP

The morning focus group was comprised of 13 former workers, both hourly and salaried, chosen by the project team and by active OCAW retirees, led by James Colvin, for their knowledge of the INEEL facility based on many years of experience. This group also participated in the risk mapping session held on a date prior to the focus groups. The afternoon focus group was comprised of 10 former workers, both hourly and salaried, who were randomly selected and who had not previously participated in a risk mapping session.

DEMOGRAPHIC BREAKDOWN

Demographic Category	**Expert group - AM**	**Random group PM**	**Total - both groups**
Gender	13 male	9 male, 1 female	22 male, 1 female
Age (average)	67.3 years	67.2 years	67.2 years - total
Median	65	65	65
Years at DOE -INEEL site	32.2 years	25.1 years	29.1 years- total
Hourly employee	11	3	14
Salaried employee	2	7	9
Reason for leaving INEEL			
-Retirement	2	5	7
-Early retirement	6	5	11
-Voluntary separation package	2	0	2
-Other Off-the-job injury/ill "No longer do the work"	 2 1	 0 0	3
Race	White - 12, Asian - 1	White - 10	White - 22, Asian - 1
Marital Status	Married - 13	Married - 10	Married - 23
Educational Level			
-Some high school or less	2	0	2
Demographic Category	**Expert group - AM**	**Random group PM**	**Total - both groups**
-High school graduate	5	2	7
-Some college or advanced vocational training	4	4	8
-College degree	0	0	0

-some post college graduate	1	1	2
-Graduate degree	1	2	3
-no answer	0	1	1
Income			
- $10,001 - $20,000	3	2	5
-$20,001 - $30,000	6	1	7
-$30,001 - $40,000	1	3	4
-$40,001 - $50,000	2	1	3
-$50,001 - $70,000	1	1	2
-over $70,000	0	1	1
-no answer	0	1	1
Religion			
-Protestant	4	4	8
-Other: Mormon	7	4	11
-Other: Own, None or no answer	2	2	4

Job Titles - Morning session: welders, press operators, machinist, mechanic, administrative, trainer, nuclear engineer, planner/estimator, utility operator, utility coordinator
- Afternoon session: engineers, reactor engineer, scientific specialist, RN, engineering technician, pipe fitter, industrial safety engineer, medical technologist, industrial hygienist

3. REPORT OF FOCUS GROUP FINDINGS BY TOPIC

The following is a breakdown of responses to questions posed by the moderator. Every effort was made to have the report follow the topics exactly as they appeared in the moderator guide. However, for continuity sake, responses to questions 2-4 of topic I, can be found under topic II in this report. These findings are based on responses by both focus groups taken together. Within each topic, the findings are broken up into the major themes that were being expressed by a number of the people in both groups.

TOPIC I: HEALTH CONCERNS - PERCEPTION OF OCCUPATIONAL HEALTH RISKS

Questions: Participants were asked if they think they are personally at risk for an occupationally-related health problem and they are asked to rate that risk (1-10). They were also asked their perceptions of risks faced by co-workers.

THEMES

1. **Participants believe a serious health risk exists for them because of unsafe conditions in the industry in the early years (ie. 20 years ago).**

The major concerns raised by the participants were:

Radiation - Participants said they witnessed and often participated in extremely unsafe practices. Workers were forced to perform unsafe acts with "hot" material or witnessed radioactive material being disposed of improperly. Finally, workers were very concerned that the radiation badges were not accurate and not properly processed. They also felt they didn't receive enough information about how much radiation they received if the badge exceeded the limit. Workers reported being sent by management into extremely "hot" areas considered very dangerous, but were removed after short periods. Workers believed they received massive doses of radiation during those periods. Also, workers sometimes did not wear their radiation badges to avoid exceeding their radiation limit. Once the limit was exceeded, they were moved to other less desirable jobs.

Lead - In order to protect themselves against what they perceived to be excessive radiation levels, the workers would fashion their own lead shielding by cutting or burning lead into whatever size protections were needed. They were exposed to lead fumes and lead dust rather extensively and often in confined spaces yet wore no respirators or gloves.

Asbestos - Many participants were required to rip out asbestos with no protection.

Beryllium - Work was done inside the reactor by hand, using beryllium.

Mercury - Large amounts were used in the processes and workers were exposed sometimes, without protection

Chemicals - Regular use of unidentified chemicals was reported. Floors were cleaned for example with trichloroethane. Also mentioned were chromates and nitric acid.

Other: Cadmium, Chromium, Noise, Heat Stress, Second hand smoke.

The major health concern expressed by the participants was cancer. They particularly mentioned bone cancer, leukemia and thyroid cancer. Unusual, difficult to diagnose radiation related problems are a fear, for example, one man suffers from monoclonal gammopathy an unusual cell problem. They often mentioned fear that the radiation seeped into or otherwise penetrated their bones and joints. Health concerns for themselves and co-workers based on the above exposures are illustrated by the following quotes.

"We used to get a lot of stuff in from Rocky Flats, from the Burial grounds, ..you had leaking barrels coming in from there, so you didn't know what kind of chemicals you were exposed to really."

"The worst thing that worries me is that they used to send us out to that cutting facility, CPP, and put us in that lead cask and put us down there, and never tell us how much radiation we got...they just say you're burned out."

"In my 40 years I was exposed to radioactive dust which probably had some radium in it."

"I'm a real living type instrument. About 1990, they decided I had a "monoclonal gammopathy" of undetermined significance...the books at the hospital say that one of the things that can give you this is radiation. It leads to bone cancer is what it does. There's a lot of guys that I know at the site had cancer of some kind. What happens is that there is one cell that just keeps cloning itself over and over and over and it pushes out other cells. So, I have a weakness in upper respiratory because of that."

"We were always using lead, every day we were handling lead. It was a shielding medium and we used it. Go in mold it around a piece of hot equipment, and you were always exposed to radiation, chemicals, mercury."

"When you had a "hot" sample or piece of equipment, you just built a lead barricade, stuck your arms around it and worked at it."

"As a chemist I know, there was radiation exposure and asbestos exposure - there was a lot of that and there was a lot of lead - those were the major ones."

"I can remember days we waded in asbestos to our knees."

2. In the early years, the management/government responsible for the facility did not do enough to protect the workers.

Most participants believed that it was only natural that as time passed, more was learned about the dangers of the hazards with which they worked and that things improved gradually as a result of education and more stringent regulation. However, there was a real sense that the employer did whatever he felt he could get away with, often putting them a tremendous risk. They felt they were the guinea pigs regularly being put into situations which were obviously dangerous.

"Radiation monitoring, for example a film badge, I feel they were not all that accurate. ...If you didn't process a film badge accurately you could get erroneous readings. When we were using those we could have got far more exposure than we thought we were getting. We never got exact amounts."

"Over the long haul you could have gotten more or less radiation exposure than was put on your permanent record."

"Many situations were very poorly handled."

"We never had an HP."

"They weren't too conscious or careful 20 years ago"

"Until the last 10 years, never any protection against asbestos either"

"We were told to wear our dosimeters on our chests immediately under our lead aprons, which only covered us from our knees to our neck and open in the back. I told the health physicist to put lead apron on outside for more accurate reading or less instead of the exposure to legs, arms and back. That was one of my concerns for years."

"My biggest concern as an hp was the insulators and welders, they stuck them in the most horrible places for long periods of time. We didn't have a lot of them, 2 or 3 guys got stuck with the "hot" jobs consistently because they had

to be done accurately and quickly. They picked up a lot of exposure."

"We participated in the learning curve."

"Sometimes there was mercury everywhere - during the fabrication of one reactor, they really screwed up."

3. Participants felt angry that physicians at the facility inadequately cared for their occupationally related health concerns.

The focus group participants, as most Americans, have a basic trust for physicians and an expectation that they will be cared for. The fact that the physicians at INEEL seemed to have no interest in or understanding of the special occupationally related health concerns which they faced working in such obviously dangerous conditions, made the participants feel angry and betrayed. The group agreed that perhaps if these doctors had done their jobs better, they wouldn't feel as worried about their health today.

"You know I went out there in '54 and everything was a little bit on the inadequate side out there in the abilities of the doctors there and everything else at that time. One time I blacked out and fell down the steps and they hauled me to the dispensary, they checked me over and saw that I had been in the lead shop. They told me I had lead poisoning, see ya. Later, I blacked out again, they took a blood count on me, told me I had lead poisoning. A third time I went down, they took a blood sample and hauled me to town to take my appendix out, it was about to rupture."

"My feeling was, the only doctors they hired there were the ones who couldn't hold a business of their own."

"Medical after the SL1 accident, was just a - something should have been instituted for a long term study to see if there is something down the road that was going to occur. But this never happened, they just - life went on and we forgot about that."

"I was just so tired all the time, and cold, the last 2 years I worked there. I was taking my physicals there at the plant as they required there at central. Three years after I left there I found out I had a thyroid count of 2.3. The local doctor said, "aren't you tired", (I thought I'd found God). I said yes, I'd been that way for a long time. I feel better now than I have in 18 years. It might not have been caused by the plant, it might have been a natural thing, but why the hell didn't they find it."

"They never kept track of your medical radiation exposure to add it to the other totals."

"Not sure if asbestos ever bothered me, they never gave me a test"

"As a medical person, in the beginning we were exposed because when radiation patients would come down, we didn't have a real standard operating procedure as to how to wash them and how to protect ourselves."

"In medical - standard operating procedures were written up after we found a hazard - to cover our butts."

"He's an industrial health care person (plant doctor), he should know what's going on in the work area."

4. Former workers expressed concern for new workers and want them cared for.

Former workers feel strongly that prevention efforts should be undertaken for current workers. Again, while they feel conditions have improved, much more can and should be done in the area of prevention and especially in terms of better medical care for the current workers.

"They give you a physical at central - for us guys here, we're all washed up, but there's people out there right now that they might be able to help. If the union is interested in saving them, they ought to have some sort of a test to give to some of these suspect victims."

"For these workers today, there should be closer monitoring and monitoring of airborne exposures and stuff like that."

"This will benefit those coming up more than it will us who have been there and done it. You got to look at what can we do for the new guys that are coming in."

5. Participants felt that this program is raising workers' awareness about these issues.

Many focus group members felt that the focus groups, risk mapping and eventual health program are all helping to raise the awareness of the former workers about their exposures and their potential health problems. Many expressed a new found desire for more information.

"If the doctor knows what you have been exposed to he can help. But unless they know to look for specific things, they can miss it. But we often don't remember to tell him because it was part of the daily work."

"This group or your other groups might like to know, I would like to know what the latency period is for (things we were exposed to)...asbestos, beryllium, cadmium."

"We'd like to know, how long these things ... how long does some of this stay in your body and how much does your body wash it out?"

TOPIC II: HEALTH CARE DELIVERY/UTILIZATION ISSUES

Questions:

1. Participants were asked about their current needs and current medical programs. What health services they currently receive and where they receive these services.
2. Participants were also asked if they would participate in a health program, what they would like to see in the program and where/how would they like to see the program administered?
3. Finally, they were asked if they saw any roadblocks to participation in a health program.

THEMES - CURRENT MEDICAL CARE

1. Former workers are generally conscientious about current medical care despite insurance limitations.

Focus group participants currently follow basic preventive health regimens. Most were diligent about regular physicals and about following up on any unusual health symptoms. Those that don't have regular physicals are under the care of a physician for an ongoing health problem. Most expressed annoyance at the restrictions and problems associated with insurance coverage, particularly Medicare, but most successfully worked around whatever problems they encountered.

"Medicare pays for part of it and what they don't pay my supplement does, if Medicare approves it."

"The biggest problem we notice is that if you just go in for a physical they won't cover it but if you go in, say you got an ailment, well, they'll give you an examination for that particular ailment and then Medicare would cover it."

2. Focus groups expressed trust and a preference for their personal physicians/distrust of occupational physicians.

Most participants rely on their primary physicians for their basic health needs and feel satisfied as far as it goes. If they are in need of specialty care they head to bigger medical facilities either in Idaho or in Salt Lake City, Utah. Occupational physicians in the community are not trusted by the participants because they see them as too company oriented, whether they worked at INEEL or not.

"I'm completely satisfied with my doctors, but it isn't like going to the Mayo Clinic."

"We have 1 board certified occupational medicine doctor in town and he used to work for the company",

"We feel pretty comfortable with medical community in Idaho Falls."

3. Personal physicians do not have enough information about occupationally related illnesses.

Focus group participants like and trust their personal physicians but virtually all the former workers reported that they had never been tested for illnesses or health effects related to their employment in the nuclear industry. However, they mostly feel that this is due to a lack of knowledge on the part of the primary physician. They don't blame their physicians or feel angry, they mostly feel resigned to the fact that very few physicians have the necessary expertise.

"Maybe 2 or 3 of these guys got the same condition and they don't even know it, and if their general numbers stay the same, maybe they'll die and nobody will know the difference. If they were looking at that, maybe they could be saved."

"I don't think you're going to find any of these things we're talking about in a general physical with anybody."

THEMES- HEALTH PROGRAM DESIGN

1. There was a positive feeling toward participating in a health program.

Focus group participants expressed very positive feelings about participating in a health program and felt co-workers would feel the same way.

2. Testing for specific occupational exposures is crucial.

Former workers should receive any specific tests which exist for exposures they may have had for example lead, beryllium and mercury. Everyone should have hearing tests, eye tests for welders, specifically should be performed. Also, any part of the body they could have been adversely affected by these exposures should be examined like the liver, the kidneys and the bones. Complete blood screenings looking for particular exposures and respiratory testing should be done as well. They see this as being in addition to their yearly physicals.

"We should have some kind of physical that will look at our former exposures that we have all had. We need a specific physical to address what we've been exposed to, not what the general fella or lady walking down the street has been exposed to..specific to our former job occupations."

3. Primary care physicians should administer the health program, but they need education on occupational exposures.

In keeping with their positive views about their primary physicians, they would feel most comfortable having them run this health program. They would trust their physicians to refer them to other specialists or facilities as needed. But while the former workers trust their physicians, they do not currently feel they have all the training necessary to conduct this program. They would like to see an appropriate training program for physicians to bring them up to speed on handling occupational exposures.

"I would think that if these guys just went to their doctor like they're saying to get their physical and they would mention to him about a special test, he may not be aware of it and that could be a problem. But just ask him for it and he'll give it to you. My doctor learned about this thing I have by reading books and calling other doctors."

"We all want doctors who are conversant with what happens to people with chemical exposures."

4. Education about occupational exposures should be provided to the former workers.

They themselves also wish to be educated so they can monitor and control their own care. Questions came up consistently about whether or not a particular exposure was actually hazardous, how it would enter the body, what the latency period would be for illness and what type of health problems would be associated with particular exposures.

"I have acute adult lymphoblastic leukemia. My doctor says this could come from radiation. I am convinced it was not from my on the job exposure, but my wife is convinced it was."

5. The health program should be ongoing and comprehensive.

The program should be long term to benefit all the former workers as long as they need it, since so little care was given to them while they were working. Also, they want a health program that treats them as well as diagnoses their conditions.

6. Travel is not a roadblock.

The participants felt strongly that they would be willing to travel long distances to take advantage of this program.

"For any medical purpose, many have to travel. You have to decide, how much is your health worth".
"I'd travel 50 miles for a free physical, wouldn't you".

"We rode the buses back and forth, what difference would one trip make one day a year."

6. Participants want the health program to portray the nuclear power industry in a positive light.

Those in the focus groups believe that the industry has vastly improved and that this program should emphasize that it will address health concerns which came out of past exposures. They worry that if the program is not conducted with a positive spin, it will be used to criticize the industry, the work they do and their jobs.

"They (the community) squalled about the shipment of the (nuclear) waste going through the site and the state and everything, and that bothers everybody. Yet they had this train derail the other day had 30,000 gallons of formaldehyde. There's a lot of that stuff goes out on the trains and trucks every day, that's much more dangerous than anything comes out of the site."

"When you start these things, whether you're going to start monitoring people or physicals or what, to put a positive spin on why you're doing it. That's been the hard part with atomic energy all the way."

"Hopefully, one of the things that I like about this program is that ...you got the people here who are on the job and you're not going to get a lot of theoretical B.S. There are some people here in the state who make a living as I see it bashing the INEEL and talking about hypothetical exposure to this and that. One of the benefits that's going to come out of this is OCAW is going to be able to say to anybody, we know what exposures there are. And you podiatrists and other feather merchants, we aren't going to have to listen to you anymore."

THEMES - ROADBLOCKS

1. Cost is always a concern.

Given they are on fixed incomes and given the limitations of Medicare, the participants do not want the program to be costly, and feel it should be adequately covered by insurance or preferably be free. They would not want excessive cost to stand in the way of success.

"The problem with us retirees, of course, we don't get a free physical, Medicare won't cover it".

"Lets give a little attention to us now and not take it out of our measly retirement. These tests cost big bucks....20% is 20%."

2. Denial by former workers that they may have a health problem.

There was a general sense that many people just don't want to know if they have a serious health problem and getting them to participate may be difficult.

Moderator reported conversation with one former worker who chose not to participate saying,
"I haven't had a physical for 9 years and I'm doing fine, I'm doing okay".

"You've always got a few people for reasons I don't understand who say, I guess I don't want to know."

3. **Former workers may distrust the program if it is being run by INEEL or DOE.**

Focus group members felt strongly that this program must clearly be run by OCAW. Most former workers wouldn't trust a program run by INEEL or the DOE or one they incorrectly perceived was being run by INEEL or the company. They felt the company and the DOE failed to care about their health while they were being exposed and failed to care for any medical needs that may have arisen as a result of exposures.

"I'd like somebody other than DOE hired physicians to give us the physical - you need an independent."

"We need somebody non-biased, that would be the biggest thing."

4. **Participants worry that when the program finally gets set up it will be too late for them**

Former workers feel their unique health needs have gone uncared for so long that many of them will die before they have the opportunity to participate in this program.

"Most of us are going to be gone before this is implemented."

"I called a gentleman for risk mapping and he said, you're 30 years too late."

TOPIC III - OUTREACH/ACCESS AND HEALTH EDUCATION INFORMATION, RESOURCES

Question: What are the best ways to reach former workers and how do they currently receive health education information?

Best ways to reach former workers:

1. INEEL retirees newsletter - reaches 500 out of 3,000 retirees
2. Retiree clubs
3. Telephone calls based on personnel lists, union lists or telephone books
4. OCAW newspaper
5. Area newspapers
6. Letters
7. AARP chapter
8. Public Service Announcements

Current health information:

1. Reading material in doctors offices
2. Magazines
3. Television
4. AARP
5. Internet
6. Information available at the Pharmacy
7. Mail from advertisers
8. Friend in the medical profession

4. **OBSERVATIONS**

The use of the focus group method in this needs assessment facilitated by OCAW worker-investigators has created a meaningful body of information which very likely could not be obtained in any other manner. This discussion with former workers at the INEEL facility with an average age of 67.2 years and an average number of years working on the site of 29.1 years has created an tremendous wealth of information about a site where exposure data is virtually non-existent. The memories captured here are from notes taken at the focus groups by the report's author, the flipchart notes taken by the scribe and from the audio taping done at both groups. It has been noted that there is a lack of available information about early exposures of these workers, some of whom were hired when the facility opened in 1949. But, discussion with the group revealed the extreme security measures taken by the contractors and by the government to protect this dangerous and unusual facility. The INEEL is the country's premier experimental nuclear energy facility conducting experiments with nuclear power that are replicated nowhere else in the U.S. The INEEL also contains the largest stockpile of weapons grade plutonium in the entire world. This helps to explain why it may have been so difficult in the past to uncover the necessary information about worker exposures. And, therefore, why it was so essential to hear directly from the workers about their years at INEEL.

This report accurately reveals the responses the focus group participants had to the questions posed. There was a basic similarity of themes in the experienced group in the morning and the random group in the afternoon and any important themes, even if they only emerged out of one group, were reported. However, underlying the basic responses there existed a contradiction that emerged over and over. That is the contradiction between their anger and distrust of INEEL management and DOE for allowing the blatantly unsafe conditions they reported, and their core belief that nuclear energy is safe and their resultant desire to protect the good name of INEEL. As older former (mostly retired) workers, they resolved this contradiction by saying that times have changed and the terrible conditions they faced many year ago have been eradicated. However, it is unclear whether they feel this adequately clears up the contradiction because they still expressed concern for current workers and strongly wanted the union to take action to protect them. Given the anti-nuclear sentiment existing in many circles in this country, they seem to feel it prudent to handle internal site problems quietly, while refusing to bash nuclear power in public.

Despite the wide range of educational backgrounds reported by the participants, the group was clearly made up of very smart and sharp people. It seemed obvious that working in such a dangerous and technically challenging environment requires a smart and curious worker able to understand and operate in a highly technical and exacting work situation. They were proud of their abilities and their hard work and felt that were making a real contribution even though they were often misunderstood by the general public.

Most discussions inevitably returned to the strong belief that they were as they said "guinea pigs" and "ahead of the learning curve". And while they could accept that they worked in a dangerous industry made especially so by the experimental nature of the work being performed there, they could not accept that those responsible for their safety and the safety at the facility in general either let them down, or just plain didn't care enough to take even the minimum safety precautions dictated by common sense and human decency. And while they believe management should have cared for them and should be taking care of them now as well, given their many years of loyalty, they just don't trust INEEL or DOE enough to let them run a health program. They trust OCAW and this seemed true even of those non-union personnel who participated in the focus groups. The quote below sums up this very basic overall feeling that most of the participants shared.

"We did this yes to earn a living, but the employer had a responsibility to protect us even way back when and did not do this, so we're kind of the guinea pigs now. And I'm saying that its gone on long enough. Lets have a little attention given to us before we're upstairs or downstairs, where ever we're going. Lets give a little attention to us now and not take it out of our measly retirement to have to follow this health screening...I feel it is partly the responsibility of our former employer whether it be a contractor, DOE , the Atomic Energy Commission or whatever. We gave our best years to the contractor or to the United States government. Now how about turning around here a little bit and taking care of us folks."

5. RECOMMENDATIONS

In conclusion, the results of the focus groups comprised of the former nuclear workers at the INEEL facility in Idaho have produced the following recommendations:

♦**The need exists for a medical surveillance program.**

Focus group members clearly report significant concern about occupationally related health symptoms and diseases based on exposures while working at the INEEL facility.

♦**The medical program must clearly be run by OCAW.**

Distrust of their employers and of the DOE would prevent the former workers participating in the focus groups from becoming involved in a health program run by either entity. Outreach about the program should make it perfectly clear who is conducting the program.

♦**The medical surveillance program must be set up in a manner that does not portray the nuclear power industry in a negative light.**

Despite distrust of INEEL management and DOE, no one wants to see attacks on the nuclear power industry.

♦**The program should begin as soon as possible, given the advanced ages of the eligible participants.**

♦**Local community primary care physicians are the first choice for providing the medical care required by this program.**

♦**An education program must be developed for the community physicians to teach them about occupational exposures.**

♦**The medical program should diagnose and treat the former workers and follow them as long as needed to complete their care.**

They understand that not all former workers with all diseases will be able to be selected for this program, but they would like to see complete care for those who are involved from beginning to end. They would also like to see the program run for long enough to reach all the eligible former workers.

♦**Keep costs low. Participants will travel.**
Location of the program is not important, but keeping costs low is crucial.

♦**An education program should also be set up for the former workers.**
They expressed a desire to be actively involved in their own care starting with a basic understanding of occupational disease.

♦**Outreach is best accomplished through the INEEL retirees newsletter, retiree clubs, personal telephone calls and the OCAW newspaper. Secondarily, area newspapers, letters, the AARP chapter and public service announcements.**

Section VII

QUESTIONNAIRE SURVEY RESULTS

Appendix A: Questionnaire

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Health and Exposure Questionnaire Survey

Methods

In order to obtain exposure and limited health information from a broad cross-section of the former workforce at INEEL, a questionnaire was developed and sent to a random sample of 1,000 retired and terminated INEEL workers. The base population from which this sample was drawn included a total of 5,154 workers, consisting of 2,140 retirees who currently receive pension from Lockheed-Martin; 2,709 workers terminated by Lockheed-Martin since 1994 (when Lockheed-Martin became the site contractor); and 305 retirees who currently receive pension from Argonne West.

In order to ensure adequate representation from the retirees who had left INEEL in the 1960's and 1970's, we stratified the list of Lockheed-Martin retirees by decade of retirement. We selected all of the retirees on the Lockheed-Martin retiree list from the 1960's and the 1970's (n = 120) and 480 of the 2,020 Lockheed-Martin retirees from the 1980's and the 1990's. This represented a 24% random sample of the retirees from the 1980's and the 1990's. In addition, we randomly selected 300 (11%) of the 2709 workers who had been terminated from INEEL from 1994 to the present. Finally, we randomly selected 100 (33%) of the 305 Argonne retirees. Hence, we weighted the sample in favor of retirees (versus terminated workers), especially the earlier INEEL retirees and in favor of the Argonne West retirees. This weighting was done in order to ensure that we had maximum information from the group that was likely to have had the most employment during early calendar years of INEEL operation and also probably the highest duration of employment and exposure. This corresponds to the group that is *a priori* most likely at risk for occupational disease due to employment at INEEL. Since the overall number of retirees at Argonne West was limited, we over-sampled from that group in order to ensure an adequate number of questionnaire responses.

A seven-page questionnaire was developed (Appendix A) that requested information on demographic status; history of job title, exposures, and job locations at INEEL; health concerns; current health care; and interest in screening and education. A check list of 35 specific exposures were included in the questionnaire. The questionnaire was approved by the Institutional Review Boards of LMTCO and Queens College of the City University of New York. A copy of the questionnaire was sent to the selected 1,000 individuals with a cover letter signed by Robert Wages (OCAW International President); the local OCAW union president at INEEL; and Steven Markowitz, MD. A second mailing of the same questionnaire with a slightly revised cover letter was sent to non-respondents approximately 6 weeks after the first mailing. Addressed stamped return envelopes were included in each mailing. The questionnaires were sent by first class U.S. mail in order that the letters with incorrect addresses would be returned to the project office.

We report here the preliminary findings from the returned completed questionnaires. We have recently received approval from the Institutional Review Boards of LMTCO at INEEL and Queens College to place telephone calls to former workers who have not responded to either of the mailings of the questionnaire. This will be done later in October in order to improve the response rate and to provide further information about correctness of the current address list that we have for former INEEL workers.

Results

Of the 1,000 questionnaires sent, 62 (6%) were returned by the U.S. Postal Service due to an incorrect address. Of the remaining 938 individuals, we received 450 (48%) completed questionnaires. There were 7 questionnaires returned from family members of former INEEL workers indicating that the workers had died.

Table 1 provides some basic information about the individuals who responded to the questionnaires. Most (80%) of the respondents were retirees, either from INEEL or Argonne West. The remaining 20% received were questionnaires from terminated INEEL workers. The response rate from the retirees (366/700, or 52%) was better than from the terminated workers (90/300, or 30%). Most (85%) of the Argonne West retirees to whom we sent questionnaires (n=100) returned a completed questionnaire, which was considerably better than the response rate from the INEEL retirees (282/600, or 47%).

Two-thirds of respondents were between ages 60 and 79, with the remaining one-third was evenly divided between workers aged 59 or less, or aged 80 and over. 99% (362/366) of the retirees were aged 50 and over. Interestingly, 54% (49/90) of the terminated workers were also aged 50 years and over. Over one-half of the retirees (n=216, or 59%) retired in the 1900's; an additional 91 respondents (25%) retired in the 1980's. Roughly one-fifth of the retirees retired prior to 1980.

Three-quarters (77%) of the respondents live in Idaho. An additional 10% (n=47) of the respondents lived in states that border Idaho, including Montana, Wyoming, Nevada, Utah, Oregon, and Washington. Other states with five or more respondents included Arizona (9), California (9), Colorado (5), and Texas (5).

Of note is that only 27% (n=111) of respondents had been members of OCAW. Information about membership in other unions at the facility was not requested.

Table 2 lists the exposures and their reported frequencies on the completed questionnaires. External radiation exposure was reported by almost one-half of the respondents (45%, n=205). One-fifth of respondents reported exposure to acetone, asbestos, and noise. Additional common exposures, defined as greater than or equal to 10% of respondents reporting exposure, were internal radiation, acids (i.e. - nitric, sulfuric, hydrofluoric, and hydrochloric); cutting oils; welding fumes; mercury; and carbon tetrachloride. Cadmium exposure was reported by 8% of respondents. Beryllium exposure was reported by 7% of respondents. Additional details regarding prevalence of reported exposure to individual agents is provided in Table 3.

We also examined how many respondents reported exposure to at least one of the following agents: asbestos, acids (nitric, sulfuric, hydrofluoric, and hydrochloric), beryllium, mercury, chromium, cadmium, nickel, welding fumes, benzene, cutting oils, carbon tetrachloride, trichloroethylene, and trichloroethane. Over one-third (36%) of the respondents reported exposure to at least one of these agents. This percentage increases to 40% if noise is added to the list of exposures. Note that radiation and lead are not included on this list. (Lead was inadvertantly omitted from the questionnaire.) Over one-half of questionnaire respondents reported exposure to at least three of the agents on the above-cited list.

Table 3 provides the breakdown of questionnaire respondents by facility at INEEL. One-third or more respondents reported having worked at CFA, TRA, ICCP, or TAN. An additional one-quarter of respondents reported working at IF. Of note is that individuals usually worked at more than one facility at INEEL so that the exposures occurred over multiple sites.

Table 4 provides a breakdown of the most common exposures by facility for the five most common facilities where respondents worked. Most of the targeted exposures occurred at multiple sites, though more chemical exposures were reported at ICPP than elsewhere.

We also obtained information about job titles that respondents had over their careers at INEEL. Over 300 job titles have been cited. We are currently aggregating these job titles in order to better characterize common exposures among similar job titles.

Table 5 provides information on health status and health care of respondents. Most respondents reported to be in fine health. Over three-quarters (385, or 84%) reported that their health was good or excellent. Only 28 respondents (6%) indicated that their health was poor. Three-quarters of the respondents reported that they had seen a physician during the 12 months prior to completing the questionnaire (n=348, or 76%). Only 15 respondents, or 3%, reported that they had last seen a physician more than 3 years previously. Three-quarters of respondents reported having a personal physician. Two-thirds of respondents (n=300, or 66%) reported that they have periodic checkups when they are not ill. Indeed, 90% of these respondents who report having regular checkups had a checkup during the 12 months prior to completing the questionnaire. The remaining 10% had a checkup during the previous 1 to 2 years. The vast majority of respondents have health insurance (n=392, or 86%). Only 3%, or 15 individuals, responding to the questionnaire, reported that they did not have health insurance. The remaining 47 respondents, or 10%, wrote that they were "unsure" whether they had health insurance.

Table 6 provides data on additional issues related to the need for medical screening. When asked whether they were concerned that their health might have been affected by working at INEEL, 40% (n=164) reported that they were somewhat or very concerned about this issue. The remaining 60% (n=248) reported that they were not concerned that their health was affected by working at INEEL. Indeed, most respondents (292, or 72%) reported that they did not believe that their health is currently affected by having worked at INEEL. One-fifth of workers (n=82, 20%) reported that they did believe that their health had been affected, and an additional 30 workers (7.4%) were unsure about this issue.

The majority of the respondents were interested in participating in a medical screening if offered. Nearly 60% of respondents (n=242, or 59%) stated that they were somewhat to very interested in participating in a screening.

The majority of respondents reported that their personal physician knew that they had worked at INEEL (Table 6). 62% (n=244) reported this belief, whereas, 35% (n=138) reported that they did not believe that their physician was aware of their previous work at INEEL. However, when asked if their personal physicians were aware of their specific exposures that they had had at INEEL, the vast majority (295, or 78%) reported that they did not believe that their physician was aware of the specific exposures that they had had at INEEL. Only 21% (80) respondents believe that their physicians did know of the particular exposures that they had experienced when they had worked at the plant.

Table 1
Respondents Employment Status and Age

Employment Status	No. of Respondents	%
Retired	366	80.3%
Terminated	90	19.7%
Employer		
Argonne West	85	18.6%
Lockheed-Martin (or predecessor)	395	81.4%
Age (years)		
30-49	32	7.0%
50-59	34	7.5%
60-69	185	40.6%
70-79	112	24.6%
80+	60	13.2%
Retire Year		
Pre-1980	**39**	10.7%
1980-1989	**91**	24.9%
1990+	**177**	48.4%
Retired Due to Disability		
Yes	**29**	7.9%
No	**291**	79.5%
Unsure	**1**	0.3%
N/A	**45**	12.3%
OCAW Union Member		
Yes	**91**	24.9%
No	**238**	65.2%
Unsure	**2**	0.5%
N/A	**34**	9.3%

Table 2

Most Commonly Reported Exposures

Chemicals and Agents	No. of Respondents Reporting Exposure	%
External Radiation	205	44.9%
Acetone	97	21.2%
Noise	92	20.1%
Asbestos	91	19.9%
Internal Radiation	65	14.2%
Nitric Acid	60	13.1%
Cutting Oils	59	12.9%
Welding Fumes	57	12.5%
Sulfuric Acid (Battery Acid)	57	12.3%
Mercury	52	11.4%
Carbon Tetrachloride	51	11.2%
Hydrofluoric Acid (HF)	46	10.1%
Hydrochloric Acid (HCL)	45	9.8%
Heat	41	9.0%
Paint or Paint Thinners	40	8.8%
Cadmium	37	8.1%
Dusts (Wood, Coal, Fibers)	35	7.7%
Beryllium	33	7.2%
Trichloroethane	33	7.2%
Other	32	7.0%
Sodium Hydroxide	30	6.6%
Chlorine	29	6.3%
Copper	29	6.3%
Freon	29	6.3%
Benzene	26	5.8%
Chlorinated Solvents	24	5.3%
Chromium or Chromic Acid	24	5.3%
Methyl Ethyl Ketone (MEK)	24	5.3%
Repetitive Motion, Vibration	22	4.8%
Nickel	15	3.3%
Silica	15	3.3%
Fluorine	12	2.6%
Methylene Chloride	11	2.4%
Arsenic	5	1.1%
Acrylonitrile	4	0.9%
Phosgene	4	0.9%

Table 3

Respondents' Work Sites

Site Name	No. of Respondents Reporting Work	%
CFA*	180	39.5%
TRA*	172	37.7%
ICPP*	171	37.5%
TAN*	146	32.0%
IF*	118	25.9%
AW*	85	18.6%
ARA*	56	12.3%
PBF*	53	11.6%
RWMC*	50	11.0%
NRF*	50	11.0%
OMRE	4	0.9%
AEC	2	0.4%
EOCR	2	0.4%
WRF	2	0.4%

Table 4

Frequency of Reported Exposures by INEEL Facility

	TRA		ICPP		AW		TAN		CFA	
Chemical/ Agent	No. of Respondents Reporting Exposure	%	No. of Respondents Reporting Exposure	%	No. of Respondents Reporting Exposure	%	No. of Respondents Reporting Exposure	%	No. of Respondents Reporting Exposure	%
External Radiation	**84**	48.8%	**86**	50.3%	**39**	45.9%	**47**	32.0%	**20**	11.1%
Asbestos	**28**	16.3%	**26**	15.2%	**14**	16.5%	**23**	16.0%	**21**	11.7%
Noise	**26**	15.1%	**33**	19.3%	**20**	23.5%	**21**	14.0%	**21**	11.7%
Acetone	**25**	14.5%	**28**	16.4%	**15**	17.6%	**17**	12.0%	**20**	11.1%
Welding Fumes	**23**	13.4%	**19**	11.1%	**10**	11.8%	**19**	13.0%	**16**	8.9%
Cutting Oils	**15**	8.7%	**0**	0.0%	**11**	12.9%	**18**	12.0%	**17**	9.4%
Internal Radiation	**23**	13.4%	**18**	10.5%	**6**	7.1%	**11**	7.5%	**0**	0.0%
Paint/ Paint Thinners	**9**	5.2%	**14**	8.2%	**13**	15.3%	**10**	6.8%	**10**	5.6%
Dusts	**12**	7.0%	**0**	0.0%	**10**	11.8%	**13**	8.9%	**14**	7.8%
Sulfuric Acid	**13**	7.6%	**25**	14.6%	**7**	8.2%	**8**	5.5%	**8**	4.4%
Carbon Tetrachloride	**14**	8.1%	**14**	8.2%	**5**	5.9%	**7**	4.8%	**5**	2.8%
Mercury	**9**	5.2%	**22**	12.9%	**0**	0.0%	**9**	6.1%	**6**	3.3%
Heat	**0**	0.0%	**18**	10.5%	**9**	10.6%	**11**	7.5%	**6**	3.3%
Nitric Acid	**9**	5.2%	**35**	20.5%	**0**	0.0%	**8**	5.5%	**0**	0.0%
Hydroflouric Acid	**0**	0.0%	**30**	17.5%	**0**	0.0%	**0**	0.0%	**6**	3.3%
Cadmium	**11**	6.4%	**0**	0.0%	**7**	8.2%	**0**	0.0%	**0**	0.0%
Freon	**0**	0.0%	**0**	0.0%	**6**	7.1%	**0**	0.0%	**6**	3.3%
Hydrochloric Acid	**0**	0.0%	**20**	11.7%	**0**	0.0%	**0**	0.0%	**0**	0.0%
Sodium Hydroxide	**0**	0.0%	**16**	9.4%	**0**	0.0%	**0**	0.0%	**0**	0.0%
Beryllium	**15**	8.7%	**0**	0.0%	**0**	0.0%	**0**	0.0%	**0**	0.0%
Copper	**0**	0.0%	**0**	0.0%	**7**	8.2%	**0**	0.0%	**0**	0.0%

Table 5

Questionnaire Responses: Health Status and Care

	Retired		Terminated	
	No. of Respondents	%	No. of Respondents	%
Overall Health				
Excellent	76	20.8%	33	36.7%
Good	179	48.9%	40	44.4%
Fair	53	14.5%	6	6.7%
Poor	25	6.8%	3	3.3%
N/A	33	9.0%	8	8.9%
Last Doctor Visit				
Within past 12 months	289	79.0%	60	66.7%
Within past 1-3 years	34	9.3%	13	14.4%
> 3 years ago	7	1.9%	8	8.9%
N/A	36	9.8%	9	10.0%
Have Personal Physician				
Yes	294	80.3%	56	62.2%
No	39	10.7%	25	27.8%
N/A	33	9.0%	9	10.0%
Regular Check-ups				
Yes	250	68.3%	51	56.7%
No	79	21.6%	30	33.3%
Unsure	1	0.3%	0	0.0%
N/A	36	9.8%	9	10.0%
Date of Last Check-up				
Within past 12 months	229	62.6%	41	45.6%
1-2 years ago	23	6.3%	8	8.9%
>2 years ago	14	3.8%	6	6.7%
Unsure	6	1.6%	2	2.2%
N/A	94	25.7%	33	36.7%
Have Health Insurance				
Yes	321	87.7%	73	81.1%
No	7	1.9%	8	8.9%
N/A	38	10.4%	9	10.0%

Table 6

Questionnaire Responses: Health Concerns Related to INEEL Employment and Medical Screening

	Retired No. of Respondents	Retired %	Terminated No. of Respondent	Terminated %
Level of Health Concern				
Very Concerned	35	9.6%	6	6.7%
Somewhat Concerned	90	24.6%	33	36.7%
Not Concerned	205	56.0%	45	50.0%
Unsure	2	0.5%	0	0.0%
N/A	34	9.3%	6	6.7%
Believe Health Affected by INEEL Work				
Yes	61	16.7%	21	23.3%
No	238	65.0%	56	62.2%
Unsure	24	6.6%	6	6.7%
N/A	43	11.7%	7	7.8%
Screening Interest				
Very Interested	72	19.7%	20	22.2%
Somewhat Interested	119	32.5%	33	36.7%
Not Interested	138	37.7%	29	32.2%
Unsure	2	0.5%	1	1.1%
N/A	35	9.6%	7	7.8%
Physician Aware of INEEL Work				
Yes	196	53.6%	49	54.4%
No	112	30.6%	27	30.0%
Unsure	9	2.5%	3	3.3%
N/A	49	13.4%	11	12.2%
Physician Aware of INEEL Exposures				
Yes	67	18.3%	13	14.4%
No	232	63.4%	65	72.2%
Unsure	2	0.5%	0	0.0%
N/A	65	17.8%	12	13.3%

APPENDIX A

ID# ____________ (do not complete)

FORMER INEEL WORKER QUESTIONNAIRE

Name ______________________________
First Name   Middle Initial   Last Name

Address ______________________________
Street Address (mailing address)

____
City   State   Zip Code

Telephone Number ☐☐☐ - ☐☐☐ - ☐☐☐☐
Area Code   Number

Date of Birth ______________________________
Month   Day   Year

Social Security Number ☐☐☐ - ☐☐ - ☐☐☐☐

Work Status ☐ Retired

(*Please check one*): ☐ Currently Employed

☐ Unemployed, but not retired

- *If you are currently employed*, what type of job do you have?

Job ______________________________

- *If you are currently retired*, what year did you retire? ________ year
- *If you are currently retired*, did you retire due to a disability?

☐ Yes ☐ No

WORK HISTORY We are interested in your work history at all DOE facilities and especially in potential exposures that you had at these jobs.

1. In what year did you first begin to work at any DOE site? ________ *year*
2. In what year did you stop working at any DOE site? ________ *year*
3. How many DOE facilities did you work at? ________ *number*

3a. Name the DOE sites where you worked other than INEEL:

____

4. We wish to learn more about your specific history of work at INEEL. Please complete all columns in the following table. Please begin the table with the first job that you had at INEEL and continue with each job until you stopped work at INEEL.

We are especially interested in your work in any of the following sites at INEEL:

- **Idaho Chemical Processing Plant (ICPP)**
- **Test Area North (TAN)**
- **Test Reactor Area (TRA)**
- **Central Facilities Area (CFA)**
- **Argonne West (AW)**
- **Radioactive Waste Management Complex (RWMC)**
- **Auxiliary Reactor Area (ARA)**

Please list your INEEL jobs in chronological order, beginning with your first job:

→ **First Site (for example, ICCP or TRA)** ______________________

Job Title	Building(s)	Years Worked		Comments
		Year started	Year ended	

→ **Second Site** ______________________

Job Title	Building(s)	Years Worked		Comments
		Year started	Year ended	

→ **Third Site** ______________________

Job Title	Building(s)	Years Worked		Comments
		Year started	Year ended	

4. Please continue to list details about additional INEEL sites where you worked:

Fourth Site ______________________

Job Title	Building(s)	Years Worked		Comments
		Year started	Year ended	

Fifth Site ______________________

Job Title	Building(s)	Years Worked		Comments
		Year started	Year ended	

Sixth Site ______________________

Job Title	Building(s)	Years Worked		Comments
		Year started	Year ended	

5. **Please complete the following table based on your work experience at INEEL.** If you were exposed to the agent listed in the first column, please fill in the columns to the right. If not, you can leave those columns blank.

Chemical/Agent	**Facility(s) where exposure occurred**	**Building(s) where exposure occurred**	**Calendar years when exposed**	**Exposure Level (check one)**		
				High	**Med**	**Low**
Acetone						
Acrylonitrile						
Arsenic						
Asbestos						
Benzene						
Beryllium						
Cadmium						
Carbon Tetrachloride						
Chlorine						
Chlorinated Solvents						
Chromium or Chromic Acid						
Copper						
Cutting Oils						
Dusts (Wood, coal, fibers)						
Fluorine						
Freon						
Heat						
Hydrochloric Acid (HCL)						
Hydrofluoric Acid (HF)						

Chemical/Agent	Facility(s) where exposure occurred	Building(s) where exposure occurred	Calendar years when exposed	Exposure level (check one) High	Med	Low
Mercury						
Methyl Ethyl Ketone (MEK)						
Methylene Chloride						
Noise						
Nickel						
Nitric Acid						
Paint or Paint Thinners						
Phosgene						
Radiation, external exposure such as gamma, x-ray, neutron						
Radiation ,internal exposure						
Repetitive motion, Vibrations						
Silica						
Sodium Hydroxide						
Sulfuric Acid (Battery Acid)						
Trichloroethane						
Welding Fumes						
Other (List Below)						
1.						
2.						
3						

HEALTH CONCERNS

6. **How would you rate your health overall?** *(Check one)*

☐ Excellent

☐ Good

☐ Fair

☐ Poor

7. **When was the last time you saw a physician?** *(Check one)*

☐ Within the last 12 months

☐ Within the last 1-3 years

☐ More than 3 years ago

☐ Never

8. **Do you have a personal physician?** *(Check one)*

☐ Yes ☐ No

9. **Do you have examinations when you are not feeling ill (an annual or regular check-up)?**

☐ Yes ☐ No

9a. *If yes*, when was the last time you saw your personal doctor when you were not sick annual or regular check-up)? (check one)

☐ Within past 12 months

☐ 1-2 years ago

☐ more than 2 years ago

10. **Do you have health insurance?**

☐ Yes ☐ No

11. **How would you describe your level of concern about whether your health has been affected by the working conditions at INEEL?**

- ☐ Very concerned
- ☐ Somewhat concerned
- ☐ Not concerned

12. **Do you believe that your health currently or in the future will be affected by having worked at INEEL?**

☐ Yes ☐ No

13. **How would you describe your interest in participating in a medical screening program to screen for health conditions that might be caused by exposures that you had while you worked at INEEL?**

☐ Very interested ☐ Somewhat interested ☐ Not interested

14. **Does your personal physician know that you used to work at INEEL?**

☐ Yes ☐ No

15. **Have you informed your personal physician about the chemical, radiation or other exposures that you had as an employee of INEEL?**

☐ Yes ☐ No

16. **Were you a member of OCAW union when you worked at INEEL?**

☐ Yes ☐ No

THANK YOU FOR COMPLETING THE QUESTIONNAIRE.
PLEASE PLACE IT IN THE ATTACHED STAMPED ENVELOPE AND SEND IT TO US.

Section VIII

Community and Health Inventories at INEEL

Sylvia Kieding
OCAW International Union

Community inventories at INEEL

J.C. Colvin, the retiree member of the OCAW site team, conducted inventories of area health care facilities, providers, and resources within a 70-mile radius of Idaho Falls. The inventories are a representative sample rather than a complete listing of resources. They were conducted to provide information to be used in the planning for the medical testing and risk notification envisioned for Phase II of the project.

Facility inventory

The facility inventory contains a list of four regional medical centers and seven clinics. Three clinics were rated "favorable" based on the retiree's personal experience or reports from friends. These include the Snake River Heart and Lung Clinic in Idaho Falls; the Family Emergency Center, a community clinic with walk-in care in Idaho Falls; and the Family Emergency Center West in Idaho Falls. There is a pulmonary clinic in Pocatello accessible to retirees and former workers rated neutral.

The Community Care Clinic in Idaho Falls is rated neutral, based on lack of experience or reports about the facility.

There are four hospitals listed, and the Bannock Regional Medical Center in Idaho Falls is the only one rated "favorable". It has departments of occupational medicine, neurology, pulmonary medicine, and internal medicine. Other hospitals listed include the Eastern Idaho Regional Medical Center and the Pocatello Regional Medical Center (both of which has the same departments as Bannock), and the Madison Memorial Hospital in Rexburg, which is in an outlying area to the north of Idaho Falls and contains only pulmonary medicine and internal medicine.

Clinics selected as geographically accessible to the most retirees were the Family Emergency Center East and the Pocatello Pulmonary Clinic.

Health care provider inventory

There were fifteen provider inventories completed. Most of the physicians had offices either next to the Eastern Idaho Regional Medical Center or the Pocatello Regional Medical Center. The list contained one urologist rated neutral, one internal medicine specialist, neutral; two cardiologists rated favorable; three oncologists, neutral; four neurologists, neutral; and four pulmonary medicine specialists rated neutral. No occupational medicine physicians were included, because they are considered to be too close to the contractor. There are four occupational physicians listed in the Idaho Falls telephone directory.

Community resources inventory

Four community associations were contacted as possible outreach for informing the community and former workers about the program. These include the INEEL Retired Employees Association, the Veterans of Foreign Wars (VFW), the Elks Lodge, and the American Heart Association in Pocatello. Only the VFW and the INEEL Retired Employees Association were receptive when contacted. Both of these have monthly meetings and issue quarterly newsletters. The Elks and American Heart Association appeared non-receptive to publicizing and proposed program, and Colvin thought it was because they are intimidated by INEEL. There is a PBS television station broadcasting out of Pocatello, which will put out public interest bulletins. There is a news and information radio station, which can be used for disseminating program information.