Occupational Cancer Research Centre

OCCUPATIONAL CANCER RESEARCH CENTRE STAKEHOLDER CONSULTATION REPORT

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Towards a cancer-free workplace

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BACKGROUND

Launched in early 2009, the Occupational Cancer Research Centre (OCRC) is a joint undertaking funded by Cancer Care Ontario, the Workplace Safety and Insurance Board and Canadian Cancer Society Ontario division, and developed in collaboration with the United Steelworkers. OCRC represents an innovative partnership of health, workplace safety, labour, and industry groups. Centre goals are to improve upon existing knowledge to help identify, prevent and ultimately eliminate exposure to cancer-causing substances and factors in the workplace.

PURPOSE

The purpose of the OCRC stakeholder consultation was to obtain information from various segments of the stakeholder community regarding their views on priority areas in occupational cancer research to help OCRC plan and carry out a research agenda. We primarily sought information from workers, management, health care providers and researchers in Ontario, but also received some input from stakeholders in other provinces and countries.

The consultation was carried out in two phases. Phase I consisted of an online survey to obtain information from stakeholders on their interests and needs regarding occupational cancer research, and barriers and solutions to conducting this type of research. In Phase II, follow-up interviews were conducted by telephone with a few individuals who completed the online survey and indicated a willingness to be contacted for additional input.

REVIEW AND OVERSIGHT

The protocol and plan for the consultation process were developed by the OCRC staff, in conjunction with the OCRC Steering Committee and Scientific Advisory Committee. The Office of Research Ethics at the University of Toronto determined that the project was exempt from ethics review.

METHODS

Phase I

Phase I of the consultation process, the online survey, was launched on June 6, 2009.

Distribution

The survey was available through a link posted on the OCRC website, which is hosted by Cancer Care Ontario. To encourage participation, information and the survey link were sent to potential respondents by email. The initial list of possible respondents came from the OCRC stakeholder database, which included established partners and attendees of the March, 2009 OCRC launch.

Additional contacts were obtained from labour unions, worker organizations, industrial organizations, and health care providers engaged in some aspect of occupational cancer research, treatment, or control. A scan of funded research on occupational cancer was performed to include active scientists and researchers in the field. To ensure the widest distribution possible, we encouraged contacts to pass the invitation on to other individuals in their networks. Because the invitation was passed on through stakeholder networks, it is unclear how many people received an invitation to participate.

Mode

The survey was primarily web-based, hosted by SurveyMonkey. This service was chosen because it provided an efficient survey development and administration tool that allows for private and secure data collection. For those who preferred to complete it by hand, a PDF copy was available which could be submitted by mail.

Content

The core content of the survey was presented in an open-ended format to allow respondents to express their opinions without constraint.

Respondents were asked to identify issues that they felt were in greatest need of action and research by OCRC. They were encouraged to focus on specific exposures, occupations, industries, cancers and prevention activities. They were also asked to identify barriers to conducting occupational cancer research, and potential solutions to overcome these barriers. For those indicating they are actively engaged in occupational cancer research, there was an opportunity to list several current research projects.

Personal information collected in a multiple-choice format included geographic location, occupational role, place of work or affiliation, and interest in future communication and participation with OCRC.

Respondents were given the option to provide identifying information, i.e., name, address and email, if they were interested in receiving updates and invitations from the Centre in the future. This information was not required in order to complete the survey and, if provided, are maintained in strict confidentiality by the Centre.

Analysis

Demographic information was analyzed by obtaining frequencies using SAS® software. Open-ended core content questions were first grouped by exposure, occupation, cancer and other research issues, and then frequencies were tabulated and compared by the respondents' occupational role and affiliation.

Because respondents were able to select more than one role and affiliation, groups were created by removing respondents from the pool in a pre-determined order for comparison.

These groups and their order were:
1. Worker
2. Researcher/scientist
3. Health and safety specialist, industrial hygienist
4. Health care practitioner
5. Interested citizen/advocate

Phase II

To enrich the data collected in the self-completed survey and deepen our understanding of the ideas and concerns raised in the survey, a series of follow-up interviews were conducted. Over half of survey respondents agreed to be contacted for follow-up.

Sample

In phase II of the consultation process, survey respondents willing to be contacted for follow-up were stratified into three pools:
- Worker, labour union representatives, and interested citizens
- Researchers and scientists
- Health and safety and industrial hygienists

Four respondents were randomly chosen for interview from each pool to ensure we reached survey respondents from a variety of occupational roles. A total of 12 follow-up interviews were conducted between August 12 and September 10, 2009.

Mode

Follow-up interviews were conducted by two OCRC research associates via telephone.

Content

During the Phase II interview, participants were asked to expand on and prioritize the occupational cancer issues they identified in the survey, specifically in an Ontario context. They were asked for further information as to why they believed these issues should be a priority and what sources of information led them to their conclusions. Finally, they were asked to provide feedback on Phase I of the consultation process and offer additional feedback on OCRC priority setting.

Analysis

Results from the follow-up interviews were used to supplement findings from the survey and to provide impressions to assist in the interpretation of quantitative data. Responses from questions about the survey itself will help guide future OCRC stakeholder consultation.

RESULTS

Phase I

Respondent Characteristics

Between June 6 and July 25, 2009 we received 177 completed surveys from stakeholders representing a variety of roles, affiliations and geographic locations.

Respondents were directed to the survey in a variety of ways. Most respondents (52%) received the survey link by email directly from the OCRC. A sizable group (24%) received it from a colleague or co-worker. Only one respondent independently found the survey link on the OCRC website. The remaining respondents received the link from other groups, organizations, or industries including:

- American Industrial Hygiene Association
- Worker's Health and Safety Centre
- Canadian Manufacturers and Exporters
- Occupational Hygiene Association of Ontario
- Workplace Safety and Insurance Board

The majority of respondents (78%) were located in Ontario. Nearly 10% came from other provinces in Canada, and the remaining 12% were located internationally, including the United States, France, Scotland and Australia.

The largest proportion of respondents identified themselves as researchers and scientists (29%), or health and safety specialists (27%), though a variety of occupational roles were represented (Table 1).

Table 1: Occupational role of survey respondents

Occupational role*	Frequency	Percent
Researcher/scientist	52	29.4
Health and safety specialist	47	26.6
Industrial hygienist	25	14.1
Interested citizen/advocate	21	11.9
Health practitioner	14	7.9
Policy analyst	13	7.3
Knowledge translation specialist	12	6.8
Worker	12	6.8
Employer	5	2.8
Other	25	14.1

*Respondents were able to select more than one role

From those that identified as being actively engaged in occupational cancer research (30% of respondents), the survey sought information on the types of research they are currently engaged in. Forty-four different occupations or exposures were mentioned as being under investigation. Only three were mentioned by more than two participants, i.e., asbestos listed by nine, pesticides by five, and firefighters by four. For a complete list of research topics being pursued by survey participants see Appendix A.

Participants reported a variety of workplace affiliations, including academic institutions, government, labour unions, non-governmental organizations, industry, health and safety organizations, and health care organizations (Table 2).

Table 2: Workplace affiliation of survey respondents

Workplace affiliation*	Frequency	Percent
Academic institution	45	25.4
Government	24	13.3
Labour union	23	13.0
Non-governmental organization	21	11.9
Industry	18	10.1
Health and safety organization	15	8.5
Health care organization	14	7.9
Unaffiliated	6	3.4
Other	16	9.0

*Respondents were able to select more than one affiliation

Priority Areas for Occupational Cancer Research

Though there was a multitude of responses given, several recurrent themes arose around topics in greatest need of research in occupational cancer. Across occupations and affiliations, respondents showed both similarities and differences in the ways they prioritized these issues, citing exposures, occupations, cancers, and other issues of interest, in conjunction with each other or alone.

Exposures

Nearly 100 workplace exposures were identified by respondents as a priority issue in occupational cancer research (for a complete list of exposures listed, see Appendix B). Several were well-established carcinogens such as asbestos and benzene, or exposures that are currently receiving considerable scientific attention, like shiftwork. Others were exposures with unknown effects such as nanotechnology, or factors such as lifestyle attributes that may

interact with established carcinogens. The most frequently mentioned exposures of interest are listed in Table 3.

Table 3: Exposures in greatest need of research

Exposure	Frequency	Percent
Shiftwork	16	9.0
Chemicals (in general)	15	8.5
Asbestos	13	7.3
Pesticides	11	6.2
Nanotechnology	8	4.5

When responses were stratified by respondents' occupational role and affiliation (i.e., workers, researchers and scientists, health and safety specialists and industrial hygienists, health practitioners, and interested citizens), there was agreement on several broad types of priority exposures (see Appendix C).

Some interesting similarities and differences across groups regarding exposures of concern include:

- Fuels and engine exhausts, contaminated air and water in the work environment, and asbestos identified by all groups
- Chemicals (in general) listed by all groups, except health practitioners
- Electromagnetic fields listed by all groups, but health practitioners and interested citizens
- Uranium listed by all groups, except researchers and health practitioners
- Nanoparticles listed by researchers and health and safety specialists
- Pesticides listed by all groups, but health practitioners
- Radiation listed by all groups, except health practitioners
- Shift work listed by all groups, but workers and interested citizens
- Solvents listed by all groups, except workers
- Interactions between exposures and lifestyle factors such as smoking and stress identified by all groups, but workers

Occupations

Many respondents identified occupations that should be priorities for research by OCRC. Forty-five occupations, both broad and specific, were listed (for a complete list of occupations listed, see appendix D). The most common occupations of interest are listed in Table 4.

Table 4: Occupations in greatest need of research

Occupation	Frequency	Percent
Healthcare practitioner/worker	13	7.3
Firefighter	10	5.7
Miner	7	4.0
Construction worker	6	3.4
Farmer	5	2.8
Welder	5	2.8

Several occupations were mentioned in conjunction with specific exposures or cancers.

- Landscapers, agricultural workers, and farmers were commonly mentioned in conjunction with pesticide exposure
- Miners were of interest in conjunction with silica and lung cancer, or uranium and lung cancer
- Healthcare workers were often listed in conjunction with shiftwork

When stratified by respondents' occupational roles, most groups agreed on several occupations of interest including miners, health care workers, and firefighters (Appendix E). Health care practitioners as a group were less likely to identify priority occupations, focusing instead on exposures or cancers.

Cancers

Some respondents mentioned cancers they believed should be a research priority for OCRC (Table 5). Twenty-seven cancers, at varying levels of specificity, were mentioned (for a complete list of cancers noted, see Appendix F).

Table 5: Cancers in greatest need of research

Cancer	Frequency	Percent
Breast	17	9.6
Lung	10	5.7
Prostate	7	4.0
Brain	4	2.3
NHL	3	1.7
Skin	3	1.7

Breast cancer was the most commonly listed cancer of interest, and was identified by respondents from all occupational roles (Appendix G). Otherwise, groups differed in the cancers they prioritized. Lung cancer was commonly listed in association with radon exposure; and breast and prostate cancer in relationship to shiftwork, particularly in healthcare workers.

Other issues

In addition to research priorities involving exposures, occupations and cancers of interest, many respondents identified other issues they believe should be a priority for OCRC (Table 6).

- Many participants (32%) felt that OCRC should develop specific resources for researchers and the stakeholder community. These included exposure databases, registries, and GIS maps.
- Others recommended a need to focus on prevention efforts or the use of specific methodologies or study designs, including long-term cohorts, mixed-method studies, and biomonitoring.
- Several respondents were interested in the interaction between two or more exposures, exposures and genes, or exposures and lifestyle factors such as diet, smoking and viral infections.

Table 6: Other issues in need of research

Category	Frequency	Percent
Request for a specific resource	56	31.6
Prevention efforts	49	27.7
Research methodologies	44	24.9
Interactions between exposures	22	12.4
Compensation and insurance issues	15	8.5
Research in specific populations	8	4.5
Transferring occupational exposures to others	5	2.8
Genetic factors	4	2.3
International issues	2	1.1

Barriers to Conducting Occupational Cancer Research

Insufficient funding was identified as the central barrier to conducting occupational cancer research (Table 7). A lack of data on exposures and outcomes was also a recurrent theme, along with the difficulties associated with applying the results of occupational cancer research in the workplace. There were no notable differences on these issues when respondents were stratified by occupational role.

Table 7: Barriers to conducting occupational cancer research

Barrier	Frequency	Percent
Lack of funding	62	35.0
Lack of data	51	28.8
Difficulty applying results	42	23.7
Lack of awareness	35	19.8
Employer/industry resistance	27	15.3
Exposure relationships hard to disentangle	24	13.6
Not a government priority	17	9.6
Insufficient human resources	17	9.6
Not a public priority	15	8.5
Need for collaboration	11	6.2
Implications for insurance/compensation	10	5.7
Small population to study	9	5.1
Long latency period	9	5.1
Privacy issues	5	2.8
Methodological issues	5	2.8

The most commonly cited solution to addressing these barriers was to form collaborations (Table 8). Collaborations suggested by survey respondents included:

- Researchers, employers, and workers
- Researchers, policy makers, and labour unions
- Multi-disciplinary researchers
- Stakeholders and researchers from various geographic regions

Other popular solutions to barriers to occupational cancer research included encouraging an increase in awareness of occupational exposures, expanding training and education, and strengthening policies and regulations. Additional funding was mentioned as a solution, but not as frequently as some other suggestions.

Table 8: Potential solutions to barriers in occupational cancer research

Potential solution	Frequency	Percent
Collaboration	27	20.5
Training, awareness, education	24	18.2
Policies and regulation	10	7.6
Additional funding	9	6.8
Registry or exposure database creation	8	6.1
Government prioritization	7	5.3
OCRC itself	5	3.8
Higher quality exposure information	4	3.0
More causal information	3	2.3
Increased data access	3	2.3
Seek opportunities for data linkage	3	2.3
Focus elsewhere	2	1.5
Other	20	15.2

Interaction and Collaboration with the OCRC

To facilitate collaborations and knowledge transfer, the OCRC needs to know how members of the stakeholder community would like to interact with the Centre in the future. The majority of respondents to this survey (59%) indicated they would like to receive regular updates about the Centre's activities and progress (Table 9). Many (35%) also indicated they would like to take a more active role and to participate in OCRC research activities.

Table 9: Respondent's interest in OCRC involvement

Level of Involvement*	Frequency	Percent
Receive updates on the centre's current activities and progress	105	59.3
Actively collaborate on specific research products	62	35.0
Assist with and facilitate research activities	61	34.5
Check the OCRC website for updates on my own time	61	34.5
Consult on specific research projects and/or establishing research priorities	58	32.8
Communicate and translate research findings into policy/actions	54	30.5
Other	19	10.7

*Respondents were able to select more than one option

We sought information on how the OCRC could best communicate with stakeholders. Many participants recommended maintaining an up-to-date website (73%) and hosting workshops

and conferences (70%). Other frequent suggestions included distributing electronic reports or newsletters (58%) and the use of Internet-supported exchange tools (44%).

There were some interesting similarities and differences across groups:
- Researcher more interested in active collaboration or consultation on research projects
- All supported maintaining an up to date website
- All supportive of workshops and conferences
- All would like to receive updates on Centre activities
- Workers especially interested in internet exchange tools

One-fifth of respondents had other ideas on how the OCRC should communicate with stakeholders including media exposure, particularly through television, and targeted engagement for priority industries and students.

Phase II

Participant Characteristics

Survey respondents who indicated they were willing to be contacted for follow-up were divided into three groups:
- Worker, labour union representatives, and interested citizens
- Researchers and scientists
- Health and safety and industrial hygienists

Four people were interviewed from each group.

Comments on Identified Research Priorities

Follow-up interview participants were asked to expand upon and prioritize the research priorities they listed in the online survey. Issues that arose from these free-flowing discussions were:
- The need to focus on exposures not traditionally thought of as carcinogens (e.g. potential exposures in office buildings)
- An emphasis on the immediate need for information on the health effects of nanotechnology
- The need for OCRC to facilitate knowledge transfer and exchange, including providing research results that can be applied with greater ease

A few interview participants offered cautionary advice. One participant challenged whether it is possible to conduct meaningful occupational cancer research in Ontario given de-industrialization, small populations and low levels of exposures. Another participant suggested

we evaluate whether policies or regulations that are established based on occupational cancer research are effective in reducing the number of new cases.

Interview participants indicated that they used a variety of sources of information to determine the types of issues they concluded were the most important for occupational cancer research. Key information sources included:

- Personal work experience
- Research careers focused in the field
- Membership in unions/committees/worker associations
- Health and safety and workplace cancer training workshops
- Academic literature
- Use of the Ontario compensation system
- Common sense

Suggestions for Priority Setting

Participants almost unanimously emphasized the need for public visibility, transparency, and a focus on knowledge transfer and exchange. They emphasized the need to make sure that results are communicated with the public in an accessible format.

Several participants shared concerns that many workplace carcinogens have not been identified, but also warned against setting off false alarms based on preliminary results.

Another common suggestion for priority setting was to establish collaborations between researchers, industry committees and working groups, management, and policy makers. It was recommended that the OCRC seek representation on some key industry and policy groups, and continue to conduct stakeholder consultations such as this one to stay in touch with interested parties.

A handful of participants gave very specific suggestions, including encouraging a focus on etiology, prevention, and interactions; and to ensure we focus on cancers other than lung, which is commonly studied.

One participant suggested that occupational cancer research may not be a subject in need of additional funding because of the low number of people affected and the barriers to conducting this type of research.

Consultation Process

The majority of follow-up interview participants found the online survey to be a convenient and easy-to-use tool. Many felt the questions allowed them to express their opinions easily, though two participants felt it would have been beneficial to use closed-ended questions, and to be

more specific. The use of SurveyMonkey was perceived as an inexpensive and easy option, though one participant questioned whether or not it was secure enough to collect confidential information.

DISCUSSION

Survey Results

Survey respondents suggested a wide variety of exposures, occupations, cancers, and other issues that should be research priorities for the Occupational Cancer Research Centre. Despite the diverse backgrounds of respondents, there was agreement on several key priority areas. Although these group differences are interesting, it is possible that they are chance findings because they are based on small numbers and unequal-sized groups.

Exposures, Occupations, and Cancers

Recommended areas of focus across groups included exposures such as shiftwork, asbestos, pesticides, and nanotechnology, as well as a general interest in potentially carcinogenic chemicals in the workplace. These exposures represent a mix of well-established carcinogens (asbestos), suspected but not proven exposures (pesticides), topics that are *au courant* (shiftwork) and exposures where the effects are still largely unknown (nanotechnology).

Role- and affiliation-level analyses produced some interesting findings. For example, electromagnetic fields were identified as an exposure of interest by almost all groups, but was still not at the top of the priority list, whereas nanotechnology was at the top of the list overall although it was only identified as a priority by the researcher/scientist and industrial hygienist/health and safety specialist groups. Shiftwork was also at the top of the list over all, but was not identified as a priority exposure by workers or interested citizens. It is not clear why these differences by role or affiliation occurred, though they could reflect differences in access to information. If this is the case, the need for more intensive and effective knowledge transfer to all groups in the stakeholder community is underscored.

Occupations of interest follow a pattern similar to exposures in that they represent a mix of well-studied industries with established health hazards such as miners, as well as occupations more recently brought to the forefront such as health care workers. There was in general, however, less consensus across stakeholder groups in identifying priority occupations than for other topics. Few patterns emerged, though almost all groups listed miners as an important topic of interest.

Cancers listed most frequently by survey respondents correspond with those most prevalent in the overall population. There were also some very specific cancers mentioned such as adenocarcinoma of the lung and childhood leukemia, which has been linked to parental occupational exposure. Interestingly, breast cancer was identified most commonly as a suggested research priority, despite the fact that occupational cancer research has not been

clearly linked to many occupational exposures. This may reflect the interest among survey respondents in shiftwork where breast cancer is a special concern.

Survey respondents also focused on issues that reach beyond exposures, occupations and cancers. Even those exposures, occupations and cancers that received the most attention were only listed by 10% or less of the survey sample, whereas requests for specific resources were mentioned by over 30% of respondents. This indicates that stakeholders believe activities intended to enhance our capacity to identify and prevent occupational cancers are just as important research projects related to specific exposures, occupations or cancers.

Addressing Barriers

The most common barriers to conducting occupational cancer research that were identified by survey respondents were the lack of funding and difficulties applying results. There was a disconnect, however, between barriers and solutions. Only 7% of respondents indicated additional funding as a solution, even though a lack of funding was the number one barrier. A greater number of respondents chose to focus on collaboration and awareness as the most effective solution, rather than simply indicating more funding is needed. It may indicate they believe collaborative activities may bring about funding indirectly, or that they believe the research community has little control over funding issues.

Connection with Ongoing Research

The relationship between recommended research priorities and research projects currently listed as ongoing indicated that several topics listed by respondents are receiving considerable attention, though there are some gaps to be filled. Priority issues such as asbestos, pesticides and firefighters are being addressed by current research, but, only one respondent said they were working on projects related to nanotechnology, two on shiftwork, and no respondents mentioned conducting work specifically on healthcare workers. It could be that work is being done by researchers in these areas who did not participate in the survey. Our sense, however, is that these are some areas that could benefit from additional attention and effort.

Future OCRC Involvement

Respondents' showed a strong interest in OCRC activities. About 65% of the survey participants were interested in establishing and maintaining a connection with the OCRC and 35% would like to take an active role in collaborating on research projects. This indicates stakeholders are dedicated to working with the OCRC to prevent occupational cancer. This strong base of support is a decided advantage for the OCRC.

Follow-up Interview Results

The results of the follow-up interview emphasized several topics that were important to survey respondents and provided a better understanding of how participants conceptualized their answers. Most importantly, the follow-up interviews reinforced that our stakeholders want research that is applicable to workers as of essence for the OCRC.

The follow-up interview also elicited some frank cautionary advice about the challenges that arise in conducting occupational cancer research. Problems mentioned include deindustrialization, small populations, and low levels of exposures. These comments were particularly valuable for OCRC priority setting as they underscore the need to take a serious look at the feasibility, effectiveness and potential impact of research projects before they are taken on.

IMPLICATIONS FOR OCRC PRIORITY SETTING

The results of this consultation provide important information to the Occupational Cancer Research Centre as we set our research priorities and plan research projects. Several key messages emerged from the survey. First, there are many occupational cancer issues in need of research, and there are both consistencies and differences among the stakeholder communities regarding which are the most important issues. Second, resource building and knowledge transfer and exchange should be priority issues for the OCRC. Finally, stakeholders are committed to addressing issues on occupational cancer and the OCRC can greatly benefit from their enthusiasm and input as we plan our agenda.

The stakeholder community will be invited to be engaged in OCRC activities on an ongoing basis through participation in our annual Research Day and future stakeholder consultations, as well as research and knowledge translation activities.

APPENDICES

Appendix A: Complete list of research topics being explored by survey respondents

Topic	Frequency	Percent
Exposures		
Asbestos	9	5.08
Pesticide	5	2.82
Benzene	2	1.13
Creosote	2	1.13
Radon	2	1.13
Shiftwork	2	1.13
TCE	2	1.13
Bitumen	1	0.56
Diesel fumes	1	0.56
Smoke	1	0.56
Solvent	1	0.56
Copper	1	0.56
Zinc	1	0.56
Electromagnetic fields	1	0.56
Nanomaterials	1	0.56
PAH	1	0.56
Light at night	1	0.56
Second hand smoke	1	0.56
Aromatic amine	1	0.56
Chemical	1	0.56
Diesel	1	0.56
Gasoline	1	0.56
Oxidative stress	1	0.56
DNT	1	0.56
Radioactive	1	0.56
Silica	1	0.56
Xray	1	0.56
Gamma ray	1	0.56
TFE	1	0.56
Occupations		
Firefighter	4	2.26
Miner	2	1.13

Agricultural	1	0.56
Boilermaker	1	0.56
Nickel miner	1	0.56
Uranium miner	1	0.56
Wait staff	1	0.56
Hotel maid	1	0.56
Nuclear	1	0.56
Oil and gas industry	1	0.56
Pesticide sprayer	1	0.56
Petroleum industry	1	0.56
Steel work	1	0.56
Painter	1	0.56
Truck driver	1	0.56
Cancers		
Breast	4	2.26
Bladder	1	0.56
Brain	1	0.56
Colorectal	1	0.56
Kidney	1	0.56
Leukemia	1	0.56
Lung	1	0.56
Lymphoma	1	0.56
MDS	1	0.56
Mesothelioma	1	0.56
Multiple myeloma	1	0.56
NHL	1	0.56
Prostate	1	0.56
Renal cell carcinoma	1	0.56
Testicular	1	0.56
Other		
General	7	3.95
Case study	2	1.13
Compensation	2	1.13
Other Disease	2	1.13
Policy and policy evaluation	2	1.13
Transferring exposure to nonworkers	2	1.13

Treatment	2	1.13
Disability	1	0.56
Interactions/effect measure modifiers	1	0.56
Knowledge transfer and exchange	1	0.56
Method	1	0.56
Pharmacogenetics	1	0.56
Registry	1	0.56
Toxicology	1	0.56
Gender	1	0.56
Screening	1	0.56
Other	6	3.40

Appendix B: Complete list of exposures identified, listed alphabetically

Exposures			
Agricultural exposures	Cytotoxic drugs	Nanofibers	Shiftwork
Air	Diesel	Nanoparticles	Shotcrete
Air freshener	Diet	Nanotechnology	Sick building
Alcohol	Dry cleaning	Nickel subsulfide	Silica
Amines	Dust	Nickel	Smelter fumes
Ammonia	Electromagnetic	Nuclear	Smoking
Antineoplastic drugs	Environmental tobacco smoke	Office	Solvent
Asbestos	Exhaust	Oil	Stress
Asphalt	Fiberglass	Oil mist	Styrene
Base metal	Food combustion	Oil tailings	Sulfuric acid mist
Benzene	Formaldehyde	Paint	Sulfur
Blasting fumes	Formalin	PCB	Sun
Brake dust	Fuel	Pesticide	TCE
Carbon black	Fungicide	PHC	Tungsten
Cell phones	Gas	Physical activity	Underground diesel
Chemicals	Gold	Plastic	Uranium
Chlorine	Herbicide	Plastic bottle	Vapour
Chromium	High temperature frying	Pressure treating	Waste treatment
Cleaning chemicals	Indoor air	PVC adhesive	Water
Coal tar	Ionizing radiation	Radiation	Welding fumes
Cobalt	Lead	Radiofrequency	WIFI
Cobalt dust	Lead in water supply	Radon	Wood dust
Computers	Metal working fluid	Reagent	Xray
Coolant	Methamphetamine	Resin	Xylene
Copiers and printers	Mold	Sawmill	

Appendix C: Exposures identified by respondents, divided by major occupational classification (categorizations adapted from Siemiatycki et al.[1])

Exposure Category	Worker	Researcher	Health and safety	Health practitioner	Interested citizen
Chemical	Chemicals	Chemicals Formaldehyde	Air fresheners Chemicals Chlorine Cleaning chemicals Coolant Formaldehyde PCB Radon Sulphur	Formalin Methamphetamine	Chemicals PHC
Electromagnetic fields	Electromagnetic fields	Electromagnetic fields	Electromagnetic fields	--	--
Exhaust	Diesel	Diesel Exhaust	Underground diesel fumes	Gas	Gas
Food preparation	--	High temperature frying	Food combustion	--	--
Lifestyle	--	Alcohol Diet Smoking Stress	Physical activity Smoking Stress	Physical activity Smoking Stress	Diet Stress
Metals and metal compounds	Uranium	Cobalt Nickel Tungsten Welding fumes	Uranium	--	Chromium
Nanomaterial	--	Nanoparticles	Nanotechnology	--	--

[1] Siemiatycki, J. et al. Listing Occupational Carcinogens. *Environmental Health Perspectives*. 112.15 (2004)

		Nanofibers	Nanoparticle		
Pesticide	Fungicide Herbicide Pesticide	Agricultural exposures Pesticide	--	--	Pesticide Pressure treating
Pharmaceutical	--	--	Anti-neoplastics	--	--
Plastic and rubber	Plastic	--	Plastic	--	--
Radiation	Cell phone Copiers/printers Ionizing radiation	Radiation WIFI	Cell phone Computer Nuclear Radiation Radio frequency X ray	--	Radiation Sun
Respirable dusts and fibers	Asbestos	Asbestos Silica	Asbestos Blasting fumes Fiberglass Paint Silica Waste treatment Wood dust	Asbestos Sawmill	Fiberglass
Shiftwork	--	Shiftwork	Shiftwork	Shiftwork	--
Solvent	--	Solvent	Dry cleaning Solvent Styrene TCE	Xylene	Benzene
Wood, fossil fuels and oils	Coal tar	Metalworking fluid	Asphalt Oil mist	Oil	Oil
Work environment	Indoor air Lead in water Sick building	Environmental tobacco smoke	Indoor air Office	Indoor air Mold Water	Lead in water

Appendix D: Complete list of occupations identified, listed alphabetically

Occupations		
Agriculture	Industrial	Paper
Autoworker	Kraft paper maker	Paver
Carer	Lab technician	Pesticide handler
Construction	Landscaper	Pharmacist
Dental	Lumberer	Plumber
Dry cleaning	Marine	Researcher
Farmer	Mechanic	Restaurant
Firefighter	Metalwork	Road worker
Flight worker	Millworker	Roofer
Foundry	Mining	Steelworker
Gold miner	Morgue	Transit
Greenhouse	Nickel miner	Tree planter
Hairdresser	Nuclear	University
Health and safety	Nurse	Welder
Healthcare	Painter	Wood preserver

Appendix E: Occupations identified by respondents, divided by major occupational classification (classifications based on the List of SOC Occupations [2])

Occupation Category	Worker	Researcher	Health and safety	Health practitioner	Interested citizen
Building and grounds cleaning and maintenance	--	--	--	--	Tree planter
Business and financial	--	--	Health and safety	--	--
Computer and mathematical	--	--	--	--	--
Construction and extraction	Miner	Construction Miner Nickel miner Steelworker	Construction Gold miner Miner Painter Road worker	--	Construction Metalworker Miner Painter
Farming, fishing and forestry	Agriculture Lumberer	--	Agriculture Farmer Greenhouse	--	--
Food preparation and serving	--	--	Restaurant	--	--
Health care practitioners and technical	Healthcare	Carer Healthcare	Carer Dental Healthcare Lab technician Morgue Nurse Pharmacist	Healthcare	--

[2] List of SOC Occupations, United States Department of Labour, URL: http://www.bls.gov/oes/2001/oes_stru.htm

Installation, maintenance and repair	--	--	Auto worker Mechanic Mill worker	--	Mechanic
Personal care and service	--	Hairdresser	--	--	--
Production	--	Nuclear Welder	Dry cleaning Nuclear Welder	Paper	Foundry Industrial Kraft paper Wood preserver
Protective services	--	Firefighter	Firefighter	Firefighter	--
Transportation and material moving	Flight worker	--	--	--	--

Appendix F: Complete list of cancers identified, listed alphabetically

Cancers		
AML	Laryngeal	Neuroblastoma
Bladder	Leukemia	NHL
Brain	Liver	Ovarian
Breast	Lung	Pancreatic
Childhood	Lung adenocarcinoma	Prostate
Colon	Lymphoma	Sarcoma
Cutaneous lymphoma	Mesothelioma	Skin
Esophageal	Multiple mylenoma	Testicular
Hematopoietic	Nasal	Thyroid

Appendix G: Cancers identified by respondents, divided by major occupational classification

Worker	Researcher	Health and safety	Health practitioner	Interested citizen
Breast	Bladder	Brain	Breast	Breast
Nasal	Brain	Breast	Testicular	Colon
	Breast	Childhood		Cutaneous lymphoma
	Esophageal	Colon		Laryngeal
	Hematopoietic	Lung		Lung
	Laryngeal	Mesothelioma		Lung adenocarcinoma
	Leukemia	Ovarian		Multiple mylenoma
	Lung	Prostate		Prostate
	Lymphoma	Skin		Skin
	Mesothelioma			
	NHL			
	Pancreatic			
	Prostate			
	Skin			

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