



Interior Health

June 21, 2012

BC Environmental Assessment Office
Attention: Lindsay McDonough and Scott Bailey
Project Assessment Officer; Executive Project Director
Kamloops Open Pit Mine Proposal
Environmental Assessment Office
1-836 Yates St, Victoria BC
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Dear EAO staff,

Feedback on Proposed Ajax Open Pit Mine Project Health Sub-working Group Meeting on air and noise by Interior Health Authority Health Protection Medical Health Officer, Dr Peter Barss

Introduction General macro-level concerns regarding the EAO review of the Kamloops open-pit mine proposal have been summarised in another document that will be submitted separately. Such issues have also been discussed by the BCCDC's Environmental Health Physician Dr Catherine Elliott in another document to be submitted; some of her concerns are covered below. In addition to our recommendations and those of BCCDC, the BCCDC has recommended reports from independent expert consultants in health effects of air and noise, mining chemists, geochemists, geologists, and in integrated HIA, HRA, and EIA. This awaits EAO funding. An opinion has also been requested from BCCDC radiation experts. In sum, the IHA and EAO must work together to guard and protect the health of the populations at risk, about 100,000 in and around Kamloops city, and if ore is shipped overseas rather than processed in BC, many other populations will require protection by other Health Authorities and the EAO along project shipping routes in and along the highways. As stated by the HIA fact sheets of the National Collaborating Centre for Healthy Public Policy, citizen participation in all phases of the EIA, HIA, and HRA is part of the democratic process and a cornerstone of HIA, and essential to ensure that all populations at risk are fully informed. Sufficient funding and random sampling of the public are required to ensure representative participation and equity considerations, and should be demonstrable at all phases of HIA, including screening, scoping, appraisal, reporting, and evaluation.

GENERAL CONCERNS

Statistical issues: In order to provide a fully informed consent to the populations at risk regarding health hazards, biostatistical population health expertise is required to ensure that probabilistic sampling with adequate sample sizes for various low and high risk population groups and locations are sampled, as in stratified random sampling, in order to predict the many potential health risks and outcomes before, during, and after the project. For both air and noise, all affected populations and sites should be randomly sampled, including city neighbourhoods and facilities, the mine pit, tailings, storage facilities, waste rock. Sampling, projections, and simulations must consider and include all phases of the project, such as construction, operation, decommissioning, and on into perpetuity.

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Population data should be provided for expert review of fine and ultrafine particles and chemicals in the dust, both from the ore and introduced by the proponent, including also reactants from chemical reactions during mining. Also to be included should be emissions, direct from the mine and indirect from powered equipment and mobile sources during transport. Hence, sources of pollution and receptors, together with details of all pollutants and of monitoring for each must be clearly characterised for all phases of the proposed mine, construction, operations, decommissioning and post-decommissioning.

Potential technological failures and natural disasters should also be considered, including drought, dust storms and other possible effects of global warming and desertification. Since the area is desert in nature, usual assumptions about dilution of pollution by rainfall would not be expected to apply for particulates in air, on soil, and in aquifers. Hence due consideration must account for this, as well as smoke from forest fires and the impact of additional dust particulates from soil if major water consumption by the mine, and other factors such as drought, global warming, and expansion of the city with rising water demands can be expected to increase aridity of the area.

Sampling should also include noise, particulate and volatile pollution in the local area and all communities, First Nations Bands, and health authorities affected by transporting of the ore to and through adjacent and distant sites. Review and approval should be considered by EAO from all affected Health Authorities, including Vancouver Coastal, Fraser, and First Nations Health Authorities. While population based probabilistic sampling is essential, if modeling is also done, all inputs, outcomes, methods and assumptions should be clearly stated for each model. Best and worst case and most probable scenarios should follow, established by sensitivity analyses for the life of the project and into perpetuity. While geographic sampling for different neighbourhoods will be essential, sampling will also need to include all special vulnerable populations by age, sex, pregnancy, and disease/immune status among the general population and workers in and around the mine. In addition to population based monitoring, monitoring of pollutant and noise hot spots should be included.

Policy of proponent and British Columbia government regarding contents of mine and tailings cores and added chemicals: Proponents should be obliged to provide detailed core constituent data from top to bottom of a proposed mine, added chemicals, tailings composition, details of water intake and output, and expected long term health effects prior to acceptance of a project for EAO review. Exceptions might be considered for elements such as gold or copper if the proponent can demonstrate no human health risk. A policy of secrecy regarding toxic metals, radionuclides, and mining process chemicals is untenable and constitutes a potential health hazard to the public and a large waste of public funds for fundamentally incomplete reviews once a project has been accepted for environmental and health review by EA, EIA, HIA, and HRA.

Need for valid population-based estimates and simulations of noise and particulates: Simulations of blast and machine noise, particulate material, and other pollutants should be conducted in order to provide realistic projections for the various populations at risk from the project in different locations of the city. Such simulations should realistically reflect the conditions when the mine should be operational, with special attention to sleep disturbances during warmer months when windows will be open, since it is currently projected to operate 24/7, within the city limits. Health effects for the population and workers should be greatly ameliorated if the mine were allowed to operate only during usual working hours and not at nights and weekends. All health and water projections of the mine should reflect worst case scenarios including global warming over the life of the mine, contamination of aquifers and the watershed, desertification, reduced natural water supplies, and so forth.

Ethical issues: Surveys that involve humans including environmental sampling at homes normally require research-ethics board approval from the Interior Health Authority, including sampling frame, type of sample, sample size, power considerations, and other requirements. The investigators should apply to

the Interior Health Authority Research Ethics Board, which makes the decision as to whether full or short review is required for studies.

Integration of proposed air, noise, and other sampling with EIA, HIA, and HRA, and with Other Issues and Sampling such as Soil and Water and Country Foods: The EIA does not at present include any methods for an HIA for the affected populations at risk in and around the city of Kamloops, on and along the roads to the coast, nor HRA for workers. It is unclear how the air and noise proposals from the proponent will feed into and provide the necessary data for a sound and comprehensive HIA for the 100,000 people in and around Kamloops and the 300 to 1000 construction phase and operation phase workers. The air and noise modeling should be linked to the human health risk assessment so that they provide the appropriate inputs for that assessment of predicted outcomes. Both air and noise proposals should quantify long-term effects on water, soil, humans, other animals including cattle, game, and fish. **The** EAO will need to organise expert working group meetings on the human health impact assessment phase and the links to EIA sampling and other considerations in the environmental assessment phase prior to approval of sampling plans unless they will be repeated using the most appropriate methodology for human exposures. Recording and other documentation will be essential to ensure valid representations of all future working group meetings.

Interactions: Health and environmental effects, including pollution and noise, may be additive or multiplicative. Hence, interactions should be considered for both. This needs to include current backgrounds, estimate best and worst case scenarios for the mine noise, emissions, and accumulations in water and soil, 24/7 and throughout the year, as well as with changing backgrounds under sensitivity analyses of different possibilities for growth of traffic, housing, industry and so forth. Combined effects of community and workplace exposure of workers and their families should be quantified for all main residence neighbourhood locations and occupations to provide total exposures from both sources.

Demonstrated Competence and Minimum Standards for Proponent's Consultants, Staff, Companies, and Senior Management: Minimum qualifications, training, professional experience, publications, and specific EIA, HIA, and HRA expertise of noise experts and particulate monitoring team should be provided for initial review phase, construction, and throughout the 23 year mine life, for both noise and pollutants travelling by air to various locations. The particle sampling team could be necessary for perpetuity if the tailings are stored on site and so those qualifications and advance funding would need to be established. The main multinational and all other associated mining proponent's environmental and environmental health records with respect to controlling air and noise pollution in operating open pit and other mines, including in close proximity to major population centres, should be fully disclosed under all present and former names, and community references provided for all present and past mines. EIA, HRAs, and HIAs and their outcomes should be disclosed. This information is essential given the high risk of an open mine within a major urban centre. This has high relevance to the air and noise sampling plans when human health protection is a consideration.

Action levels for partial and/or complete, temporary or permanent mine shutdown: Action levels for different sampling locations singly and jointly should be defined in advance for all scenarios and types of interactions, including health and well-being risks to the communities affected, as well as workers. These could include acute and cumulative particulate and noise levels, and other Issues such as water and power shortages. The proponent's consultant noted that mitigation measures for noise are costly and not very effective so shutdown might be necessary for noise alone and the criteria would need to be agreed upon and documented in advance as this will relate to adequacy of sampling.

SPECIFIC AIR AND NOISE ISSUES

Air: Clean and safe air is essential every moment of our lives. Monitoring of emissions should be continued well beyond the life of the mine, possibly into perpetuity, particularly if the very high tailings piles would be left in place within the city of Kamloops. Hazard elimination and uncertainty regarding the post-project phase is to be preferred and a preferable alternative would be to regularly remove the tailings to a safer site much further away from the city and vulnerable water supplies. Data should also be provided on the cumulative levels of particulate emissions in soil, water, and air for each neighbourhood over the entire projected life of the mine, and if the tailings piles are not moved well away from the city and stored in a secure location, into perpetuity, with funding provided by the proponent before the project begins. A key issue is that the population at risk and taxpayers should not have to pay for damages, even if the proponent moves away to their offshore base, or declares bankruptcy late in the project when damage to health and the environment could be most serious and costly, as occurred with arsenic tailings threatening the Yellowknife water supply, involving a US gold mining company at the Giant Mine in the NWT.

Population based sampling of all neighbourhoods at risk is essential, and a biostatistician should be engaged to develop an acceptable stratified sampling plan for the city and surrounding areas, including those of concern for the First Nations band, and generalisable to all main neighbourhoods of the city, not only a few high risk homes close to the mine. While perhaps useful for certain purposes, old sampling data from the Domtar pump mill seven miles away is inappropriate for estimating population health risk in all neighbourhoods in the city, with a proposal of a large open pit mine within the city limits. Such sampling should not be at the expense of probabilistic sampling in neighbourhoods within one or two kilometres of the proposed mine. Of concern is that the proponent's Stantec air consultant was unfamiliar with population sampling, had not engaged a biostatistician, and disagreed with these considerations. Hence, specialised expertise in the health realm will. It is also worrying that the proposed sample size was very small and the sampling method nonprobabilistic for city neighbourhoods. While such a sample and associated modeling might be considered adequate for an emissions source remote from a centre or a meteorological survey, it is manifestly unsuitable for a major open pit mine within city limits, and only two kilometres from the nearest school and many residents, and in proximity to the hospital and university. In addition to feral animals, many cattle graze and fish swim near the mine. Their intake of heavy metals on grass or in the water is of serious human health concern and must be sampled for throughout the project and onwards if contamination persists. Animals and fish may need to be excluded and/or declared unfit for consumption at any time before, during, and after the project. The type of monitors to be used should be clarified, such as the Newgold and others.

The human effects of exposure to mine constituents is a critical item in human health impact assessment. It is not feasible to provide feedback on sampling plans for unknown substances. The proponent and the EAO should provide the core data of all chemicals for all locations and depths in the proposed mine, including anticipated levels of these and other added chemicals at all phases of the mine development and operations, in the air, water, ground, and other sites. The opinions and interpretations of the proponent's consultant toxicologist are not an acceptable substitute for the valid data. Air quality and particulates should not only be monitored during the initial phases of the mine, but for the coming generations when long term effects such as cancer would become apparent. All elements that are monitored for maximum acceptable concentrations in drinking water and related in air should be documented in the cores. They should also be estimated for tailings and for soil, water, and air, both ongoing and cumulative effects over the life of the mine. Effects of tailings piles and aquifers should be monitored in perpetuity, especially if they are to be retained on site inside the city limits. Details of any levels of radionuclides down to zero at specified decimal readings should be provided since there may be no threshold effects, especially during long-term emissions in air. The estimated long-term health

effects, including cancer and other diseases should be quantified using health risk assessment procedures for all city neighbourhoods and all other pertinent locations.

Interior Health Authority is still awaiting from the proponent confirmation of radionuclide levels with human health effects, such as uranium and other radioactive minerals, and silicates (silicosis) at different depths and locations in core samples, and to be expected in air particulates, water, and tailings. Interior Health is also awaiting from the proponent all potentially harmful to human health constituents of mine core contents, and all chemicals to be added during the treatment processes, with their predicted point and cumulative levels in air, ground, all categories of water, and in humans of any food products during all phases of the mine and in perpetuity after completion. Estimates should include population-based sampling with appropriate sample size for residents of all areas of Kamloops and surrounding areas as requested by First Nations and others, as well as mine workers for different exposure periods and durations. All data from previous mining in the area should be fully disclosed, as well as data from the proponent's and other similar mining operations and sites around the world. Independent ore mining chemists, geochemists, and geologists should provide detailed reports on all and especially potentially toxic products of the ore in all forms and locations. Products of chemicals added and used in mining operations should also be documented in acute form and also as predicted to result during all phases of operations, including tailings releases, during operation and after project completion.

For predicting human health effects from polluted air, it will be critical to focus on sampling of ultrafine (<0.1µm) and fine (0.1 to 2.5µm) particulates. These penetrate deep into the lungs, bypassing usual defense mechanisms. Hence focusing only or mainly on large particles will mean the Kamloops community and worker populations cannot be informed and reassured regarding hazards such as cancer and chronic obstructive lung disease, as well as other health hazards such as silicosis and other pneumoconioses arising from toxic reactive stress at alveolar level. With up to 10% of the population affected by asthma, metals can act as haptens or incomplete allergens. Data will be needed on this issue. Since the cilia of smokers may be ineffective in clearing particulate matter and damage from smoke and other mine-related air particles can interact multiplicatively, lung damage could be much more severe than expected in such higher risk populations. Hence, tobacco and cannabis smokers and others with below-normal lung defense mechanisms among working and community populations will be a special group requiring intensive monitoring during estimations of health impacts. Arsenic, asbestos, PACs, chromium, nickel, radionuclides, and all other toxic substances will require estimation prior to project approval for the mine itself and at all locations in the community. Radon baselines for all neighbourhoods, including near the mine and the rivers, should also be ascertained by population sampling.

Other issues are lifetime average daily dose (LADD) and for workers occupational exposure limits (OELs) as well as their community exposure 24/7 depending where they live in the Kamloops community. Others include zero threshold effects for cancer risk assessment, and defining risk for definite, probable, and possible human carcinogens, and combinations of those carcinogens.

Airborne pollutants in all liquid forms should be projected, simulated, and monitored on a population basis as fogs, mists, and so forth, and as solids in the form of dusts, fumes, and smoke from crushing, vaporisation of metals, and organic combustion. Air sampling should include suitable filters for trapping silica, dusts, and all other mineral particulates of small and large size with potential acute and chronic cumulative effects. Sampling should also include areas with animal populations such as grazing grounds near and at various distances from the mine in all directions, and food chain issues such as bioaccumulation in small and predatory fish and birds.

Since sampling of soils affected by air and water borne particles is complex, representative short and long term samples from home gardens and yards at all neighbourhoods and schools will be essential during the life of the proposal and into perpetuity. Similarly, acute and cumulative airborne pollutants

must be monitored and projected for all water sources including aquifers and surface water throughout typical and atypical years. This would comprise remote and proximate locations, including the pit itself and any communicating aquifers. For First Nations communities and other hunters and fishers, intake of pollutants from country foods would need to be added to intake from air, water, plants, and other sources. In river systems, small riffles and pools may be critical to the total riparian ecosystem, and the loss of such sites and vegetation at the river-land interface could result in unknown impacts from concentrated air pollution contamination of water at low water levels due to large mine water consumption, drought, global warming, and increasing urban and rural consumption.

If the proponent is to be allowed to transport raw output from the mine to coastal areas, the EOA and proponent should also communicate with the Vancouver Coastal and Fraser health authorities and all First Nations Bands along the route to develop sampling and projections to clarify contamination on and along roadways and the affected neighbourhoods and ports in Vancouver from dust in and on trucks or train cars, as well as organic and particulate emissions from the engines of trucks.

Pregnant women were excluded from sampling and models of the proponent's consultant Stantec. Women, their unborn children, and other vulnerable populations such as the immunosuppressed and/or persons with chronic diseases should be included in the sampling in sufficient numbers, such as at Thompson Rivers University and other appropriate locations.

The Stantec consultants to the proponent stated that the large amounts of power required for the project would not be a source of air pollution since they would be supplied off-site. However, they were unable to respond and clarify the question as to the location, quantity, and consequences of added pollution offsite and how this could affect human populations. This should be done, as well as for all diesel and other petroleum emissions and other chemicals in and around the site and on the highways.

Information regarding effects of mine pollutants in the form of emissions and added chemicals on water in its various forms, and the quantities involved is needed, and where the chemicals would come from and go. It was considered vital that air particulate sampling plans take this into account, including long term impacts on aquifers and lakes, fish and animals, as concern was expressed to this effect by the local First Nations Indian Band. The Thompson River is the largest tributary of the Fraser River, so effects could be wide-ranging and potentially extend to Vancouver, particular if there are long-term cumulative effects. Hence all populations and health authorities downstream from Kamloops should be alerted by the EAO and involved in the project proposal reviews.

Emissions from trucks and the long-term effects and costs in and around the mines and down to Vancouver port and the city should be quantified and clarified. The costs of damage to highways from project trucks and of road crash fatalities to other lighter vehicles should be provided and funded, as well as additional costs to other industries if trucks congest highways. Costs and benefits of alternate models should be promoted including processing at suitable sites within BC, rather than simply shipping the raw resources out of country. Comparison with train transport should also be considered. All trucks could require washing at both ends to avoid dissemination of toxic dusts, after loading in Kamloops and after unloading in Vancouver. This would be difficult to police if the operation were to continue 24/7 during more than two decades. Failing this, risk assessment and costing for deposition of such dust between Kamloops and Vancouver would be necessary.

Noise: Undisturbed rest is a fundamental determinant of health, and noise at any time can result in serious wide-ranging health effects. Health risks of the various best and worst case scenarios for different hours of operation of the proposed mine at all times of day and night throughout the seasons should be documented by thorough literature review of all pertinent databases, especially for community exposures at simulated levels in all locations for the populations sampling plan for neighbourhoods, schools, and so forth, including noise sensitive populations. Sampling and any modeling for noise should also include vibration since both have health effects. The proponent's Stantec consultant has not included vibration in their plan. That should include statistically representative

population sampling, test vibration release, and other considerations to estimate human health effects. Similarly, the noise testing must include baseline levels for quiet and noisy areas of all Kamloops neighbourhoods, and predicated levels for each based on test noise releases of all machinery operations, blasting and other noise sources at levels at and above maximums.

Conformity with local noise bylaws should be demonstrated. The sampling plan proposed is a nonprobabilistic grab/convenience/haphazard sample inadequate to predict and track noise effects that could damage health in different neighbourhoods of Kamloops, including by proximity and for strata of quieter and noisier neighbourhoods. Stantec's proposed samples for exposure times as short as only five minutes and only two non-random homes as a basis for modeling for just 24 hours were deemed completely inadequate to protect the public and so to reliably predict exposures for the many populations at risk. Actual sampling and real simulations at expected decibel levels 24/7 throughout the year would be greatly preferred to modeling on a convenience sample, and is needed to provide suitable data so that the population can be fully informed about the hazards in different neighbourhoods, times of day, seasons of the year and when the pit and tailings piles are small, larger deeper, higher. Stantec, or preferably independent consultants trained in health effects of noise, should engage the assistance of an experienced population health biostatistician to develop an acceptable stratified random sampling plan for the entire city, with sufficient power to inform residents in quiet and noisier areas of neighbourhoods, both indoors and outdoors, of what their expected noise levels would be before and after opening of the proposed mine, based upon noise simulations for blasts and machinery during prolonged sampling sufficient to take account of varying times of day, wind, temperature levels, pit depth, tailings piles heights, and all other pertinent variables, and to predict potential health effects.

The Stantec noise consultant stated that their company had had no statistical advice, and that it would be impossible to do a population based sampling on the basis of expert statistical consultation. This interpretation and attitude are not acceptable from a population health perspective and therefore constitute a potential health hazard if the mine were to be approved. Stantec should be reviewing and referencing materials from the US Environmental Protection Agency, the European Union, and other locations such as Scandinavia and Australia. The rationale for the health protection basis of noise guideline levels should be documented at least for Canada, the USA, Australia, and Europe. If proposed guidelines are not health protective for all relevant populations and scenarios, more stringent levels should be used. This is more so the case given that at the meeting, Health Canada stated that they had removed their noise standards from their website. They insisted it be removed as a reference in the noise proposal, and not be cited as a basis for a noise proposal for the mine project..

Stantec stated that simply assessing the proportion of the population to be highly annoyed by noise from the mine was acceptable and that if up to 6.5% of the population should be highly annoyed it would be acceptable. However, that would still represent about 6,000 citizens being highly annoyed by the noise. Other levels of noise annoyance should be considered and would be important since if 6,000 were highly annoyed and a much larger number moderately or otherwise annoyed, the public health impact on the population could far exceed projected levels, and manifest as many chronic diseases, stress, unintentional injuries, violence, and suicide. Again, interactions with other determinants of health effects such as air pollution could be additive and/or multiplicative.

A preferred solution would be for a public consultation as part each step in a participatory HIA to determine acceptable levels of noise for the affected populations, including quiet and noisy neighbourhoods and sub-neighbourhoods of the city of Kamloops. This could be based upon realistic simulations of blasts and typical machinery under all usual and expected conditions during the life of the mine, with monitoring of decibel levels based upon suitable stratified random sampling and interviews of the sampled population of children and adults. The community, from quiet and noisy areas of the neighbourhoods of the city, could then participate in deciding upon the levels of noise deemed acceptable for them, including the acceptable changes from baseline during all phase of the project,

rather than the proponent's consultants arbitrarily choosing a certain level. This would be in accord with recommendations from the Canadian National Collaborating Centre for Healthy Public Policy.

Of concern, the Stantec noise consultant provided contradictory information. It was first stated that as the proposed pit gets deeper, noise levels to the community would decrease. However on questioning as to whether as the pit got larger and deeper it could actually amplify and project sound, the consultant admitted that this could indeed be the case and the noise situation could get worse as the pit deepened. When asked for data on this from other pit mines, it was stated that every pit is different and it would therefore be impossible to predict noise levels for the proposed pit. Evidently, neither data from other mines nor from simulations could be useful for predicting noise levels associated with pits of varying size. When asked to provide typical noise levels in decibels at source for the types of mine equipment such as crushing machinery, conveyors, and trucks, the consultant reportedly was unable to provide this information. On questioning by the city of Kamloops about whether dispersion of noise levels from machinery to and on the tailings piles would worsen for Kamloops residents as those piles grew higher, it was admitted that indeed that could be the case. The consultant also stated that mitigation noise barriers were costly and relatively ineffective. When the mining company representative was questioned as to what the company would do if the noise was sufficient to cause high degrees of annoyance among the Kamloops population, she stated they would do everything necessary to deal with that. When asked whether that would include mine closure in the event nothing else was successful, there was no clear response. In light of the conflicting testimony on noise, documentation including peer-reviewed citations, and appropriate simulations, should be provided and/or undertaken to answer such critical questions for the health and safety of the public. Clear health and public participation based shutdown criteria will need to be established and agreed upon prior to mine construction and operations. Independent advice from a non-industry noise expert with experience in human health effects and population sampling would be advisable.

Noise levels from trucks to and from Vancouver, and of work on tailings, 24/7 for 23 years should be contrasted with alternate models including removal of tailings to a site well away from the city, together with processing and taxing of the ore within BC, rather than shipping the raw resource out of country. The Vancouver Coastal and Fraser health authorities and any First Nations bands in proximity to roads and highways should be consulted regarding noise and other issues related to large numbers of heavy vehicles for the 23 year life of the mine, including costs of wear and tear on roads, organic and particulate emissions, and road crashes. Noise and particulate mapping from sensitive receptors for all locations within the Kamloops city limits, as well as to and from the port of Vancouver, including land, riparian, lake and Pacific Ocean bodies of water will be required. Noise and particle maps with predicted levels in decibels and for all pollutants will be required for each location, throughout each phase of the project.

The proposed mine is highly unusual and poses many potential health and environmental risks. The proponent's environmental consultant was unable to provide an example of an open pit mine constructed within an existing large city's limits elsewhere in Canada. The proponent and their consultants therefore will need to demonstrate their technical capabilities, reserve finances, compassion, and will to protect the public and the environment from air pollution, noise, and other liabilities during the 23 year projected life of the mine, and into perpetuity for air pollution if toxic waster are indeed left within the city.

In sum, *quis custodiet ipsos custodes?* Who will guard the guards, who will watch the watchmen? In the current situation the EAO, Ministry of the Environment, Ministry of Mines, and the Interior Health Authority also have serious public health responsibilities and liabilities, and require independent expertise in many domains, as do the public and their elected representatives before giving fully informed consent.

Sincerely,

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