



PUBLIC HEALTH BY DESIGN

**Health Impact Assessment
of a Proposed Natural Gas Compressor Station
in Weymouth, MA**

HIA Evaluation Report

Commissioned by the Metropolitan Area Planning Council

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Acronyms

AALs	Allowable Ambient Limits
CZM	Coastal Zone Management
EIA	Environmental Impact Assessment
FRRACS	Fore River Residents Against the Compressor Station
HIA	Health Impact Assessment
MassDEP	Massachusetts Department of Environmental Protection
MAPC	Metropolitan Area Planning Council
MDPH	Massachusetts Department of Public Health
NAAQS	National Ambient Air Quality Standards
PHMSA	Pipeline and Hazardous Materials Safety Administration
SOPHA	Society of Practitioners of Health Impact Assessment
TELs	Threshold Effects Exposure Limits

Executive summary

The Metropolitan Area Planning Council (MAPC), in partnership with the Massachusetts Department of Public Health (MDPH) and the Massachusetts Department of Environmental Protection (MassDEP) undertook, in 2018, a Health Impact Assessment (HIA) for a proposed natural gas compressor station in Weymouth, Massachusetts (Weymouth Compressor Station HIA). The HIA report, *Health Impact Assessment of a Proposed Natural Gas Compressor Station in Weymouth, MA*, was published in January 2019.

In late 2019, MAPC commissioned an independent evaluation of the HIA process and report from Public Health by Design, an HIA consultancy company based in London, United Kingdom. Public Health by Design was not involved in the HIA and did not have any pre-formed opinion of the HIA and its process.

This evaluation is part of the MAPC's commitment to the quality improvement of their HIA and health in all policies practice. A key aim of this evaluation is to further strengthen the process and reporting of future HIAs by learning lessons from what was adequately covered, and what could have been strengthened, in the HIA report and process.

This executive summary summarizes the evaluation of the Weymouth Compressor Station HIA process and report.

HIA Evaluation Process and Methodology

The evaluation of the HIA process and report was undertaken using a review framework that was specifically developed as part of this evaluation. The review framework is structured as if a HIA process and report is a stand-alone assessment.

The review framework examines the scope of the HIA, the robustness, inclusiveness and quality of evidence that supports the HIA findings and recommendations, whether the communities' health profile and communities' relationship to the proposed development are adequately discussed, whether there is adequate consideration, in terms of range and analysis, of the potential health impacts, and whether there is appropriate identification and consideration of mitigation and enhancement measures for the health impacts identified by the HIA.

This evaluation was undertaken by Dr Salim Vohra and Dr Filipe Silva and externally peer reviewed by Dr Janis Shandro. The evaluation team and the peer reviewer are knowledgeable and experienced in Public Health and Health Impact Assessment.

To assist in the identification and evaluation of HIA- and project-specific conditions and limitations, and the evaluation of the HIA report and process, the following representatives from key stakeholders were interviewed in December 2019:

- Marc Draisen, Executive Director, MAPC
- Barry Keppard, Public Health Director, MAPC
- Matthew Brennan, Health Department, Weymouth
- Alice Arena, Fore River Residents Against the Compressor Station (FRRACS)
- Andee Krasner, Mothers Out Front
- Dr Phillip Landrigan, Greater Boston Physicians for Social Responsibility

The following two stakeholders were also invited but did not offer interviews. They were:

- Glenn Keith, Director, Air and Climate Programs, Massachusetts Department of Environmental Protection.
- Brenda Netreba, Community Health Assessment Section Chief at Massachusetts Department of Public Health, or her recommendation.

The following reports and documentation were reviewed as part of this evaluation:

- The Governor's Directive, i.e. the letter from Governor Charles Baker to the Mayor of the Town of Weymouth, Mayor Robert Hedlund;
- HIA project documents, including the request for proposals issued by MDPH for the HIA of the proposed gas compressor station and MAPC's response to the request;
- The HIA report, i.e. the *Health Impact Assessment of a Proposed Natural Gas Compressor Station in Weymouth, MA*, January 2019;
- The executive summary and the appendices of the HIA report;
- Materials used in the seven HIA Advisory Committee Meetings and in the two community meetings available at foreriverhia.com;
- Public comment, including the Greater Boston Physicians for Social Responsibility reports from February, May and September 2019;
- MassDEP's Air Quality Plan Approval, January 11 2019;
- MassDEP Office of Appeals and Dispute Resolution's 'Recommended Final Decision (with Goodrich Exhibit B)', June 2019 and 'Recommended Final Decision on Reconsideration', August 2019; and
- MassDEP's (revised) Air Quality Plan Approval, August 26 2019.

Limitations of this Review

Every HIA is unique to a specific context and requires a specific scope and set of evidence, and different levels of analysis and assessment. These issues speak to an inherent challenge in reviewing the quality of a HIA process and report by an external party that has not overseen the HIA process. To provide a holistic understanding of the HIA process and its reporting, this review has considered the views of key stakeholders and those of the MAPC. In this regard, a

specific limitation of this review was the inability of the reviewers to interview all members of the HIA team. The HIA team members from MassDEP and MDPH declined to be interviewed for this review because these agencies were part of an active litigation process linked to the HIA. This limited the reviewers' understanding of the HIA process and reporting from the perspectives of MassDEP and MDPH.

Feedback from key community stakeholders interviewed as part of this evaluation

Interviews were conducted separately with four community stakeholders, two of which had been part of the HIA Advisory Committee. The following themes summarize the key feedback received.

On the scope of the HIA, community stakeholders judged that the HIA was not sufficiently comprehensive or sufficiently broad in scope. For them, an important limitation was that it did not consider many public health or climate change issues related to the proposed compressor station.

Community stakeholders judged that the splitting of the assessment work, as per the Governor's Directive, across three sets of agencies was a key constraint for the HIA process and scope. The community stakeholders also judged that the HIA was not sufficiently resourced. That is, it had a short timeline and limited funds to carry out a comprehensive HIA. The community stakeholders also judged that the relationship between MAPC, as a contractor responsible for leading the HIA, and MassDEP and MDPH, acting as both commissioners and funders of the HIA, and members of the HIA team, may have constrained the HIA process.

On community input and involvement, community stakeholders considered that the HIA process sought to include community inputs and feedback and that these inputs were prominently described in the HIA report. However, they judged that community views, inputs and concerns did not permeate meaningfully into the HIA process and report. The community engagement process, specifically the HIA Advisory Committee, was therefore judged by them to be tokenistic. Some community concerns articulated during community meetings were judged by community stakeholders to be left unaddressed and community stakeholders judged that there was no specific effort to engage environmental justice communities.

On the baseline data used in the HIA, the community stakeholders considered that additional baseline data should have been collected, specifically, independent data collected by individuals or organizations with no financial stake in the compressor station.

On the literature review, the community stakeholders judged that the snowball approach used to identify literature for the review of evidence was not systematic enough and did not include evidence on the impacts of air pollution on vulnerable communities.

On the HIA methodology and methods of assessment, the community stakeholders considered that the methods for assessing certain health impacts associated with the proposed compressor station were weak, not sufficiently in-depth, or flawed. Some impacts were, therefore, judged to not be adequately characterized and assessed. Key weaknesses relate to project-related emissions to air and their associated health impacts: the perceived limited attention given to the rates of certain diseases in Weymouth and South Quincy and pre-existing high levels of air pollution in Weymouth and South Quincy, how issues of additive and cumulative risks were considered in the HIA, how the HIA conclusions failed to draw from the evidence presented in the HIA report, how thresholds and standards were not used consistently in the HIA to judge the significance of air pollution health impacts, and how the public health implications for users of the public park were assessed.

On the HIA findings, the community stakeholders considered that the HIA recommendations implied that lifestyle factors such as smoking were to blame for the increased prevalence of key health outcomes in the project-affected communities. Stakeholders felt no data was presented to support this assertion and therefore that discussing lifestyle factors was unfounded and inappropriate.

The community stakeholders considered that the HIA process could have assessed alternative sites for the proposed compressor station.

The community stakeholders judged that the HIA did not sufficiently address health equity. The conclusions did not discuss the impacts of air pollution on vulnerable populations such as environmental justice communities, children, adults with underlying health conditions and the elderly.

The community stakeholders pointed out that neither the HIA Advisory Committee nor other interested community stakeholders were given a chance to review the final draft of the HIA report before it was published.

The community stakeholders believed that the members selected to be part of the advisory committee should have included more subject matter experts in air toxics and public health.

The community stakeholders considered that the HIA did not have much influence on the decision-making process. 'Health' did not have much authority in the permitting process as MassDEP has only a small remit/responsibility for health in the process.

The community stakeholders expressed concern about the possibility that the HIA report can set a precedent for future HIAs undertaken for similar projects. Specifically, community stakeholders were concerned that the findings of the HIA report could potentially be harmful to other communities of Massachusetts. For example, allowing the Governor's assessment of the HIA, 'that it is the highest quality HIA ever done on fossil fuel infrastructure', to go uncorrected, may pave the way for future fossil fuel HIAs to be conducted in the same manner.

Feedback from MAPC representatives interviewed as part of this evaluation

Two interviews were conducted separately with two representatives from MAPC. They identified the following key issues relating to the Weymouth Compressor HIA.

On contextual factors, MAPC highlighted that the work of regional agencies involves managing objectives of municipal, state and federal agencies as well as community organizations, community groups and private businesses. In some cases, the objectives align well and work proceeds with those involved seeing mutual benefit. In other cases, each party has a different objective – or vision – for the work and in these cases, work can be extremely challenging as regional agencies seek to balance each stakeholder's requirements while seeking to prevent harm. This is particularly true when there are proposals to introduce new elements – homes, business, roads, parks – into cities and towns. Although challenging, the work is very rewarding when collaborations, with mutual respect and co-operation and honest working relationships, can be developed during the process.

When MAPC undertook the HIA, the compressor station had already undergone a number of reviews and rounds of input, which had brought forth competing objectives. The proposal to build a compressor station also occurred in the context of several state and local efforts related to climate change, clean energy and environmental pollution – all of which also involved differing and sometimes competing goals. Undertaking the HIA was meant to provide a supplemental resource in the state's review of the proposal and made no attempt to preclude other processes and other types of assessments. Additionally, the HIA, as a supplemental resource, had no statutory standing in the regulatory decision-making context. That said, MAPC could not control how the Commonwealth might use the HIA once it was completed.

On the objectives of the HIA, MAPC had a series of key objectives in undertaking the HIA:

1. Determining whether the compressor, under normal operating conditions, would damage public health in any measurable and significant ways.
2. Providing guidance on and then executing the scope of the HIA, consistent with their contract with MDPH and MassDEP;
3. Conducting the HIA in accordance with the Governor's Directive and consistent with good practice from the HIA field;

4. Bridging multiple fields to conduct the HIA (e.g., public health, environmental health, energy, land use and community planning); and
5. Engaging municipal and community stakeholders so that the HIA was based on findings that blended evidence and community voice.

For MAPC this was more than just a technical assessment. They hoped to engage in a process to demonstrate how public regulatory processes could integrate more local perspectives and community engagement for the purpose of more collaborative decision-making. MAPC recognized that this was the first HIA to be conducted in connection with an air permitting process of this kind, which very rarely involve this level of engagement and review. MAPC hoped the process could provide a starting point for more involvement and understanding of public health in such processes, and believed staff at MDPH and MassDEP shared this hope.

On the scope of the HIA, MAPC highlighted that the HIA of the compressor was screened in as a result of the Governor's Directive. The state agencies, MDPH and MassDEP, were both involved in the HIA process and were the responsible agencies named in the Governor's Directive. The scope of the HIA followed that it would not explicitly involve public safety and climate change resiliency, which were assigned to other state agencies (EOEEA and MA CZM). MAPC's role on the HIA was to provide objective guidance and management of the HIA process from scoping through reporting.

The actual scope of the HIA was determined through meetings with the Advisory Committee. The initial Advisory Committee meeting surfaced health issues of concern. At the second meeting, MAPC presented a draft proposal and then synthesized committee input, with recognition that public safety and climate change resiliency reviews would be conducted by other state agencies. Project advisors offered agreement on the scope, in regard to its three main topics (air quality, noise, and land use), although the Advisory Committee would have liked a wider scope incorporating public safety and climate change. However, the Governor's Directive, and the limited time and money, reduced the scope of what could be delivered.

On the quality of the data used in the HIA, MAPC highlighted that it had familiarity and experience working with public health and environmental data. MAPC's expertise came from previous work on multiple HIAs and public health projects, specifically work on traffic-related air pollution near highways. Although MAPC had this experience, the specificity of the data involved in the compressor station HIA required MDPH and MassDEP to play lead roles in the collection and analysis of air quality and health data, respectively. MassDEP, the regulatory authority for air permit review, had the expertise to review and ensure the quality and accuracy of the air quality monitoring and modelling data. This included data that MassDEP collected during the HIA, data provided by the proponent of the compressor, and the data provided by citizen-led air quality monitoring. MDPH had the expertise in working with cancer datasets that were collected and analyzed for in the project area. In some cases, air quality

and health data straddled expertise in both agencies (e.g., health effects of air pollution). In these cases, the agencies played a shared role in order to interpret and report back on the data.

On engaging communities, MAPC highlighted that the aim of the Advisory Committee was to engage representatives of surrounding municipalities and community organizations that were already involved with the process related to the proposed compressor station. To form the Committee, the municipalities were asked to recommend representatives, including one from their health department, and the community organizations were asked to identify participants they would like to serve on the Committee. The intent was to have representatives that were recommended by their groups, that had knowledge relevant to the process and/or the proposal, and not selected by some other process.

Each Advisory Committee meeting had a slide in the presentation that reviewed the role of the Committee. Each meeting also featured a visual aide to show where the project team was at in the process. Several of the meetings also involved segments that were intended to build common knowledge around technical terms, science and public health data so that the Committee and the project team were working from a shared understanding.

A challenge in engaging with the Advisory Committee was that many members seemed to have already decided that the compressor should not be sited in the proposed location (but seemed open to its placement in other, more rural locations). This was a challenge as HIAs, while not advocating for or against a change, operate under an assumption that the proposal will come to fruition, allowing the results of the HIA to be used to determine mitigation and other actions to reduce or address impacts. The project team recognized and respected those with pre-decided positions, but MAPC often had to clarify that we were looking to assess health impacts if the compressor were in fact built. Understandably, resulting discussions in the meetings may not always have been as productive as possible given this condition.

Evaluation of HIA-specific Conditions and Limitations

A review of key documentation and interviews with key stakeholders identified five key HIA-specific conditions and limitations that constrained the Weymouth Compressor HIA and influenced the scope and the assessment methodology of the HIA:

- The Governor's Directive influencing the scope of the HIA by narrowing its focus to air quality-related impacts.
- The Governor's Directive splitting the assessment of health-relevant issues across three agencies.
- The contractor relationship between MAPC and MDPH.
- The air quality permitting process being the main decision the HIA aimed to influence.

- MassDEP's long-standing approach to its air quality-related regulatory and permitting responsibility that is not aligned with the broader approach and ethos that a HIA should follow to assessing and managing health impacts.

The first condition that constrained the HIA was that the Governor's Directive focused the scope of the HIA on the air quality impacts of the project on the public's health. The Directive also stated that the main decision-making process that the HIA would inform was the air quality permitting process under the authority of MassDEP. The HIA would therefore not be feeding into a broader development or spatial planning consent process which is what usually happens to HIAs in the USA and internationally.

The second condition that constrained the HIA was the splitting of how the key community concerns - health impact, public safety issues and climate change considerations - across three different agencies, which occurred as a direct result of the Governor's Directive. With no explicit mandate for MAPC to require the other two agencies to produce their reports or to collaborate with MAPC it was impossible for MAPC to ensure that all three concerns acknowledged in the Directive were addressed in a complementary way that either cross-referenced impacts across the three reports or produced a single consolidated report.

The third condition that constrained the HIA was that the Governor had directed MassDEP and MDPH to undertake the HIA. Therefore, MassDEP, MDPH and MAPC did not have an equal relationship in the process and reporting of the HIA. It is possible that MassDEP, and to a lesser extent MDPH, having a supervisory role in the how the HIA was undertaken, could have constrained what MAPC could scope into and consider in the HIA. Furthermore, MAPC was in a contractual relationship with MDPH, with a fixed budget and timeline, which was likely to have also constrained the freedom MAPC had in relation to the scope, methods and process of the HIA.

Another condition that constrained the HIA was having the air quality permitting process as the main decision the HIA aimed to inform, rather than a wider spatial and development planning consent process. This constraint effectively influenced how the primary set of recommendations developed as part of the HIA were framed. These would have to be recommendations for conditions to be included in the air quality permit, should one be issued, and were therefore constrained in scope.

With regards to the assessment approach used in the HIA, it is important to highlight that MassDEP has a long-standing practice of requiring air quality modeling to assess only those ambient air quality changes that are caused by a proposed project without taking into account existing background levels. This practice by MassDEP of assessing impacts permeated into the assessment approach used in the HIA to appraising potential physical health effects from changes in air quality. However, this practice is not aligned with standard practice in HIA,

where background/baseline levels of air pollution must be considered when assessing and rating impacts.

Evaluation of the HIA Process and Report

With regards to general contextual information, the HIA report provides sufficient contextual information on the HIA that was undertaken. This aspect is judged by the evaluation team, overall, to be adequately covered in the HIA report.

With regards to the description of the proposed site and compressor station, the HIA report provides sufficient information about the proposed site, its current use and how this will change should the project move forward. This aspect is judged by the evaluation team, overall, to be adequately covered in the HIA report.

With regards to the description of the policy, legal and regulatory framework, The HIA report provides relevant information on the key aspects of the policy, legal and regulatory framework relating to the health impacts that were scoped into the HIA. This aspect is judged by the evaluation team, overall, to be sufficiently covered in the HIA report.

With regards to the governance framework and process for the HIA, the HIA report provides sufficient detail on the governance framework and process that was followed during the HIA study. An aspect that could have been strengthened was allowing the HIA Advisory Committee to review and provide comments on the final HIA report before it was published. This lack of scrutiny coupled with disagreements on the scope, methodology and findings of the impact assessment resulted in no ownership of the HIA by the HIA Advisory Committee.

With regards to the scoping process and scope of the HIA, the scoping process, and the methods used during the process, are clearly described in the HIA report. This aspect is judged by the evaluation team, overall, to be adequate. It is clear that the Governor's Directive was a key consideration in narrowing the scope of the HIA. Two other state agencies had been mandated to undertake separate and parallel reviews of the compressor station's public safety- and climate change-related impacts. In this context, the decision by the HIA team to not include these issues in the scope of the HIA is defensible. However, given the local communities' and other stakeholders' strong concerns about public safety- and climate change-related impacts, MAPC could have considered a number of alternative approaches to addressing and tackling this challenge in the scope of the HIA.

With regards to the baseline health profile, the health baseline profile of local communities is described in the HIA report. It provides sufficient information to gain an appreciation of the key existing community health issues, the existing health status of local communities, and the state of key determinants of health, that were relevant for the health impact pathways that

were scoped into the HIA. This aspect is judged by the evaluation team, overall, to be sufficiently covered in the HIA report.

With regards to the evidence used in the HIA, the breadth and depth of evidence collected and described in the HIA report is adequate, balanced and of good quality. This aspect is judged by the evaluation team, overall, to be adequately covered in the HIA report.

With regards to the identification, characterization and assessment of health impacts, the general assessment methodology described in the HIA report is appropriate and in line with international HIA practice. However, the specific methods and tools used in the assessment of each of the three themes, air quality, noise and land use, could have been strengthened in the HIA. Specifically, the assessment of air quality-related health impacts relied solely on a comparison of the predicted/modelled contributions of the compressor station to air pollution levels against MassDEP's TEL/AAL and EPA's NAAQS. This was a narrow approach to assessing impacts. As applied and described in the report, this method of assessment does not take account of wider considerations. For example, the scientific evidence on the no threshold effects of air pollution, the existing high levels of exposure to air pollution in the focus area, or the existing health burdens of project-affected populations that are important considerations for the assessment of this potential health effect. The assessment of noise-related health impacts had inconsistencies in the reporting of the reasoning behind the conclusions, specifically around the indicators used and subsequent comparisons made to regulatory thresholds, recommended by the EPA, and/or guidelines values, recommended by the WHO.

With regards to the recommendations presented in the HIA report, this was judged by the HIA evaluation team as an aspect that could have been strengthened. Three sets of recommendations were presented in the HIA report. The main set of recommendations related to the compressor station's air quality permit application. Recognizing that the MassDEP permit was the key enforcement mechanism for the implementation of the HIA recommendations, these recommendations were a reasonable and appropriate set of mitigation and enhancement measures. The second set of recommendations were presented in relation to existing 'environmental and health conditions'. These were not related to potential impacts from the proposed compressor station. Some of these recommendations focused on individual level behaviors of local community residents: reducing tobacco smoking, increasing physical activity and healthy diets, and supporting the better management and treatment of respiratory conditions, particularly in children. These recommendations unfortunately gave the impression that the fault and responsibility for the existing health issues in the project-affected communities was mainly linked to individual lifestyle choices and came across as a form of 'victim blaming'. The third set of recommendations were presented in a box headed 'Community perspectives: recommendations'. The inclusion in the HIA report of this third set of other community

recommendations, by the HIA team, was done in good faith, with the intention of not losing out on meaningful community feedback. It had the unintended effect of appearing to community stakeholders to be undercutting and delegitimizing what were reasonable and appropriate mitigation and enhancement measures.

With regards to the stakeholder engagement process, the evaluation team judged this aspect to be, adequate overall, though some aspects could have been strengthened. The key aspect that could have been strengthened related to how the feedback and evidence generated through the stakeholder engagement process were used in the HIA. This is because while stakeholders were consulted this seemed to have limited influence on the methods of assessment, findings and recommendations of the HIA. It was also unclear from the HIA report whether key vulnerable groups were consulted and engaged, specifically residents or representatives from the two environmental justice neighborhoods.

On the reporting and communication of findings, the evaluation team judged this aspect to be adequate overall.

Recommendations for future HIA practice

The following recommendations are aimed at informing future HIA practice by MAPC. They are informed by the findings of the evaluation of the HIA process and report though each recommendation does not link to a specific aspect that required strengthening, a weakness or a gap discussed previously. The evaluation team recognize that some of these recommendations would have been difficult to implement in the evaluated HIA because of the circumstances under which it was undertaken and the constraints that were imposed on it.

Recommendations on management, process and resources

- Ensure that any future contract, or agreement, for MAPC to conduct a HIA does not include substantial constraints to the scope of the HIA. It should allow for the scope of the HIA to be fully reflective of all, or the most important, health-related community concerns that emerge during the HIA process.
- Future HIAs should ensure that they are adequately funded and have a realistic timescale to undertake a good quality HIA. Funding and timescales should only be confirmed following agreement on the scope of the HIA by the HIA team and advisory or steering committee.
- Future HIA processes should include communicating the findings of a HIA directly to local communities, especially where there is disagreement among stakeholder on the findings.
- For contentious projects, consider the wider regional and national implications of the proposed project and alternative technology options and sites. This could be done by conducting a strategic regional level HIA first, before a local project level, one to understand the implications of the particular project and other similar projects being sited in the region.

The aim of this strategic HIA would be to develop a strategic approach and set of criteria to enable the siting of contentious projects in a fair and transparent manner.

- For contentious projects, where there is community opposition or concern, consider supplementing proponent-generated data, information or studies with additional independent studies, for example air, water or soil monitoring, sampling or modelling, where these are deemed appropriate or requested for by local communities.

- For contentious projects, consider having an external HIA consultant conduct the HIA, to allow MAPC to act as the coordinating agency and allow for more objectivity and challenge to the HIA, the process and the findings both from MAPC, local communities and from other stakeholders.

Recommendations on community input and involvement

- In future HIAs, community views should be given equal weight to other sources of data that informs the HIA assessment process, including the rating of impacts.

- Future HIAs should also allow for advisory or steering committee feedback, or community feedback, as appropriate, on the full draft report before it is published. Feedback received should be incorporated into the final report or justification provided why the community feedback was not incorporated. The latter issue should be discussed with communities before the publication of the final report.

- Future HIAs should make a concerted effort to engage more disadvantaged, vulnerable/sensitive and/or 'harder-to-reach' communities such as environmental justice neighborhoods.

- Future HIAs should seek to engage the proponent as a stakeholder on a HIA advisory or steering committee. This is likely to enhance ownership and implementation of the HIA recommendations on mitigation and enhancement measures.

- Future HIAs should obtain feedback from stakeholders on the effectiveness of the methods of engagement and what more could be done. Also provide a commentary, in the HIA report, on any gaps or challenges in the engagement of key stakeholders.

Recommendations on scope

- Ensure the scope of future HIAs is comprehensive and adequately assesses the key health impact pathways emerging from a proposed project. Ensure the scope of future HIAs is not artificially constrained by external factors. Should this not be possible given specific constraints or contextual factors, consider the appropriateness of terming an assessment a 'Health Impact Assessment' (i.e. avoid the use of this term) versus an assessment of specific project-related factors on public health. For example, an assessment of air quality-related impacts on public health which has used a HIA methodology, methods and tools.

Recommendations on community health baseline

- In future HIAs, expand the description and discussion of existing baseline inequalities, in health status and the state of key determinants of health, and identify health equity issues,

when inequalities could reasonably be judged to be systematic, unfair and amenable to prevention. Where inequalities and equity cannot be discussed or only to a limited extent, then an explanation should be given as why this was the case, e.g. lack of information.

- Ensure that key local health policies and regulations, e.g. municipal health regulations and local health and wellbeing plans, are considered in terms of whether the proposed project, and its siting, aligns with or goes against the aim, objectives and priorities of local health policies and regulations. The analysis and significance of health impacts and effects should also consider whether the potential positive health impacts help to reduce existing local public health burdens or whether the potential negative health impacts could worsen them.

Recommendations on literature review and evidence

- Future HIAs, should undertake as comprehensive and systematic a literature search as possible, using a clear review protocol, using recent research undertaken in the USA or in similar geographical and demographic contexts, including reviews and meta-analyses. The approach to the literature should be informed by feedback from the HIA advisory or steering committee and local communities.

Recommendations on methodology and assessment of health impacts

- Make health equity, i.e. the distribution of impacts and how they may disproportionately affect sensitive communities, such as environmental justice communities, a more prominent part of future HIAs. This could be, for example, when discussing the project-attributable impact and their characterization and assessment. Future HIAs should also analyze the health impacts and effects on vulnerable populations such as children, in particular those with a chronic condition like asthma, adults with underlying diseases like chronic obstructive pulmonary disease (COPD) and heart disease, and the elderly.

- For contentious projects, ensure that the HIA methodology of future HIAs is peer reviewed by technical subject matter experts and/or key stakeholders, as appropriate, and ensure their feedback is incorporated into the final methodology. For example, for specific technical areas such as the assessment of air quality-related health impacts or the appraisal of outputs from air quality monitoring and modelling, an air quality health expert could peer review the HIA methodology sections related to this topic.

- In future HIAs, consider taking a precautionary approach to analyzing the significance of the potential health impacts and effects and providing recommendations. This would mean impacts that are judged to be uncertain or impacts from exposures that have health effects below regulatory thresholds should be assigned some level of health effect and mitigation measures should be developed for them (see also reporting recommendations).

- Future HIAs, should use a broad judgement framework for assessing the significance of health impacts, that have regulatory thresholds, in light of the existing evidence base. That is, use a non-threshold and a below threshold level of significance where appropriate and do not over-rely on a threshold-based approach to assessing impacts. If a broad judgment

framework like the one described above cannot be used, then ensure that standards and thresholds for air, water and soil quality are used as significance criteria in a consistent way. The key issues related to this are:

- Ensure that where the existing baseline for exposures, e.g. air or noise emissions, are near or above regulatory thresholds that this is considered in the overall analysis of health effects and not just the emissions from a proposed project. This can often be done as a cumulative assessment of existing projects in an area and the proposed new project.
- Ensure that the combined impact of baseline and additional project-specific increases in air, water or soil pollution are the basis for developing mitigation and enhancement measures.
- Include a qualitative and, where appropriate, quantitative analysis of combined pollutant burden on cancer risk, non-cancer risk and all-cause mortality using EPA risk estimates.
- Ensure that in-combination additive and synergistic effects of key exposures and determinants are also considered and analyzed.
- Future HIAs, should explicitly discuss the degree of certainty or confidence attached to the prediction of health effects.

Recommendations on mitigation and enhancement measures

- Future HIAs should avoid addressing existing health needs unrelated to a proposed project, such as lifestyle-related health risks. While individual lifestyle-related health risks do need to be taken into account as existing sensitivities that could make project-related health impacts more intense, they should not be selectively targeted to minimize the implications of a project's potential health impacts. This is because lifestyle-related health risks are linked to a complex web of individual, neighborhood and societal factors and are not simply the result of individual choice.
- Future HIAs, should take a precautionary approach by recommending mitigation measures for potential negative health effects even where the effect may be judged to be small or the evidence is inconclusive or limited.
- Future HIAs, should focus the proposed mitigation and enhancement measures on project-attributable changes and impacts. Broader recommendations, where they are judged to be worth making, i.e., to address existing health needs, should be clearly labeled as not resulting from the assessment of project impacts.

Recommendations on monitoring and follow up

- Future HIAs should where possible, provide details on monitoring arrangements, who is responsible for monitoring and actioning mitigation and enhancement measures, and the timeframes for implementing them.

Conclusion

No HIA is perfect and every HIA can be strengthened and improved. This evaluation identified a number of areas of good, or adequate, practice in the HIA and a number of areas that could have been strengthened. There are two key areas that needed strengthening that are worth highlighting: the scope of the HIA and the assessment approach taken on specific impacts. In discussing these weaknesses, it is important to note the conditions and limitations that constrained the Weymouth Compressor Station HIA.

With regards to the scope of the HIA, specifically the scoping out of public safety- and climate change-related health impacts, various factors stemming from the Governor's Directive worked to narrow and constrain the scope of the HIA. The evaluation team recognize that the narrow scope is a direct reflection of the constraints and limitations imposed by the Governor's Directive. However, there were various points at which MAPC could have acted differently. At the beginning, MAPC could have asked to work in partnership with the agencies responsible for the review of public safety- and climate change-related impacts to develop a set of cross-referenced reports. During the latter part of the HIA process, once it was clear that no public safety or climate change reports were forthcoming, MAPC could have highlighted this critical health-relevant assessment gap with the commissioner of the HIA and asked for a widening of the scope of the HIA. Once the HIA report was drafted, MAPC could also have stated clearly in the HIA report that the assessment was based on a preliminary and limited HIA that could only be completed once the other two assessments were undertaken, and their reports published. It could also have recommended in the HIA report that a more detailed and wider HIA was needed if the other two assessments were not undertaken. One final action that MAPC could have undertaken, would have been to withdraw from the contract.

With regards to the assessment of air quality-related health impacts, the evaluation team considers that the HIA used a narrow approach to assessing these potential health effects. This approach relied solely on a comparison of project-attributable air emissions and their impact on air quality against regulatory thresholds. Sufficient weight was not given to the existing high levels of air pollution and the existing health status of communities in the project area. The HIA evaluation team understands this approach may have been a reflection of MassDEP's long standing practice to assessing a proposed project's air emissions as part of its air quality permitting function. That is, to appraise a proposed project's emissions without taking account of existing background levels of air pollution. This practice is, however, too narrow for the purposes of a HIA.

Finally, apart from the areas that needed strengthening, in particular the two mentioned above, much of the HIA process was undertaken in line with what is generally considered good international practice.

1. Introduction

The Metropolitan Area Planning Council (MAPC), in partnership with the Massachusetts Department of Public Health (MDPH) and the Massachusetts Department of Environmental Protection (MassDEP) undertook, in 2018, a Health Impact Assessment (HIA) for a proposed natural gas compressor station in Weymouth, Massachusetts (Weymouth Compressor Station HIA). The HIA report, *Health Impact Assessment of a Proposed Natural Gas Compressor Station in Weymouth, MA*, was published in January 2019.

In late 2019, MAPC commissioned an independent evaluation of the HIA process and report from Public Health by Design, an HIA consultancy company based in London, United Kingdom. Public Health by Design was not involved in the HIA and did not have any pre-formed opinion of the HIA and its process.

This document reports on the evaluation of the Weymouth Compressor Station HIA process and report, including a review of specific conditions and limitations associated with the HIA. This evaluation assessed the contextual factors and constraints that informed and guided the HIA process and the development of the HIA report. The evaluation criteria were based on US and international guidance on HIA. This document also provides recommendations for strengthening future HIA practice by the MAPC.

1.1 Purpose of this Evaluation

This evaluation is part of the MAPC's commitment to the quality improvement of their HIA and health in all policies practice. MAPC has conducted past evaluations of their HIAs that have led to changes in how they conduct and report their HIAs.

A key aim of this evaluation is, therefore, to further strengthen the process and reporting of future HIAs by learning lessons from what was adequately covered, and what could have been strengthened, in the HIA report and process.

This document, though it evaluates the strengths and weaknesses of the HIA process and report, is therefore mostly focused on identifying and recommending options for strengthening future practice, guided by the evaluation team's expertise in HIA, good practice US and international standards, and feedback from key stakeholders.

1.2 Guide to this Document

This document is made up of the following chapters:

- Chapter 2 describes the HIA evaluation process and methodology;

- Chapter 3 reports on the findings of the evaluation, including feedback from key stakeholders, findings from the evaluation of HIA-specific conditions and limitations and findings from the evaluation of the HIA process and report;
- Chapter 4 provides recommendations for future HIA practice;
- Chapter 5 provides concluding statements; and
- The appendices include a short biography of the evaluation team, the authors of this report, and of the external peer reviewer, the completed HIA evaluation tables, the questions asked in the stakeholder interviews, and some further detailed evaluation of the HIA report's analysis of key health impact pathways.

2. HIA Evaluation Process and Methodology

2.1 Description of Evaluation, Purpose and Methods

The evaluation of the HIA process and report was undertaken using a review framework that was specifically developed as part of this evaluation with a view to it being used, and further adapted, for future developmental reviews of HIAs conducted by MAPC.

There is no single approach to conducting HIAs or to creating a HIA report. So, the review framework was designed to enable the evaluation team to systematically evaluate a HIA process and report regardless of the methodology, methods, techniques and contents of a HIA process and report. The review framework is structured as if a HIA process and report is a stand-alone assessment. It is, though, flexible enough to allow for other assessments, carried out within or alongside a HIA, to be considered as part of the evaluation of a HIA.

The review framework can be used in two ways. It can be used as a checklist of criteria to be fulfilled by a HIA process and report at the beginning of a HIA. It can also be used after the HIA process and report are completed to identify areas of a HIA process and report that are adequately considered and areas that can be further strengthened.

The review framework was informed and adapted from the following US and international HIA guidance documents:

- A. Fredsgaard MW, Cave B, Bond A. A review package for Health Impact Assessment reports of development projects. Ben Cave Associates Ltd. Leeds, United Kingdom, 2009.
- B. Spickett J, Katscherian D. Evaluation guide for Health Impact Assessment: Guidance for Health Professionals. WHO Collaborating Centre for Environmental Health Impact Assessment, School of Public Health, Faculty of Health Sciences, Curtin University, 2017.
- C. Green L, Perry-Williams L, Edmonds N. Quality Assurance Review Framework for Health Impact Assessment (HIA). Wales Health Impact Assessment Support Unit (WHIASU), Public Health Wales (PHW), 2017.
- D. The Minimum Elements and Practice Standards for Health Impact Assessment. Society of Practitioners for Health Impact Assessment. Version 3. 2014.

The review framework examines:

- The scope of the HIA, and the health determinants and health outcomes, that are considered.
- The robustness, inclusiveness and quality of evidence that supports the HIA findings and recommendations.

- Whether the communities' health profile and communities' relationship to the proposed development are adequately discussed.
- Whether there is adequate consideration, in terms of range and analysis, of the potential health impacts, both positive and negative.
- Whether there is appropriate identification and consideration of mitigation and enhancement measures for the health impacts identified by the HIA.

The review framework was used to evaluate the HIA process and report by the evaluation team: Dr Salim Vohra and Dr Filipe Silva. This HIA evaluation report was also externally peer reviewed by Dr Janis Shandro. The evaluation team and the peer reviewer are knowledgeable and experienced in Public Health and Health Impact Assessment. Short biographies of the evaluation team and peer reviewer are available in Appendix 1. No additional advice from other specialists was sought.

The evaluation team were tasked with evaluating:

1. How the HIA was carried out.
2. The values and standards that guided the HIA.
3. The quality of the HIA that was conducted.
4. The report documenting the HIA process and its findings.
5. The robustness of the information and evidence gathered and used in the HIA.
6. The robustness of the analysis of impacts, i.e. the significance and intensity of possible health and wellbeing impacts and effects.
7. The recommendations made given the scope of the HIA.
8. The robustness, comprehensiveness and feasibility of the health management plan to minimize health risks and maximize positive benefits.

Additionally, it was important that the review process appraised the general quality of the report. Issues that were considered in this criterion include the:

- a. Logical structure and format of the report.
- b. Clarity and readability of the report.
- c. Use of tables, figures and diagrams.
- d. Degree to which all the necessary information is provided for the reader to be able to understand how and why the findings of the report were reached.

Each member of the evaluation team read and made notes on the HIA report for each criterion in the tables of the review framework. This generated a range of review findings which highlighted the aspects that were judged to be good, and of appropriate quality i.e. were sufficiently or adequately covered in the HIA process and report, and those that were judged to be weaknesses, i.e. aspects that could have been strengthened. A joint evaluation meeting was then held by the evaluation team to develop a consensus on the judgments reached for each review framework criterion. A jointly agreed evaluation summary was then prepared and is set out in Chapter 3 of this report. A draft of Chapter 3, and the whole report

was reviewed by MAPC to improve clarity and to ensure the accuracy of contextual aspects of the HIA process and report.

The completed review framework tables are provided in Appendix 2.

2.2 Understanding Contextual Factors for the Evaluation

HIAs for different types of developments in different spatial planning and decision-making processes, and different regulatory systems, require different scopes, different types of evidence, different levels of community health baseline information, different levels of analysis and assessment, and different levels of development of mitigation and enhancement measures. HIAs may also have varying expectations and concerns from communities and other stakeholders. Some HIAs may require quantitative scientific evidence on possible health outcomes; in other cases, qualitative scientific evidence and evidence from community members, especially those most likely to be affected by the proposal, or from other stakeholders, might be sufficient.

Therefore, the evaluation of a HIA process and report requires having a clear understanding of what the aim and objectives of the HIA were, why it was commissioned, what type of decision it was designed to influence, and how contentious the development was to affected community and other stakeholders, among other contextual factors. Hence it is essential to review a HIA process and report within its specific context and decision-making processes.

To assist in the identification and evaluation of HIA- and project-specific conditions and limitations, and the evaluation of the HIA report and process, the following representatives from key stakeholders were interviewed in December 2019:

- Marc Draisen, Executive Director, MAPC
- Barry Keppard, Public Health Director, MAPC
- Matthew Brennan, Health Department, Weymouth
- Alice Arena, Fore River Residents Against the Compressor Station (FRRACS)
- Andee Krasner, Mothers Out Front
- Dr Phillip Landrigan, Greater Boston Physicians for Social Responsibility

Each interview lasted between 45 and 75 minutes. Appendix 3 lists the key questions that were discussed in the stakeholder interviews.

The following two stakeholders were also invited but did not offer interviews. They were:

- Glenn Keith, Director, Air and Climate Programs, Massachusetts Department of Environmental Protection.
- Brenda Netreba, Community Health Assessment Section Chief at Massachusetts Department of Public Health, or her recommendation.

2.4 Document review

The following reports and documentation were reviewed as part of this evaluation:

- The Governor's Directive, i.e. the letter from Governor Charles Baker to the Mayor of the Town of Weymouth, Mayor Robert Hedlund;
- HIA project documents, including the request for proposals issued by MDPH for a contractor to conduct the HIA of the proposed gas compressor station and MAPC's response to the request;
- The HIA report, i.e. the *Health Impact Assessment of a Proposed Natural Gas Compressor Station in Weymouth, MA*, January 2019;
- The executive summary and the appendices of the HIA report;
- Materials used in the seven HIA Advisory Committee Meetings and in the two community meetings, including the audiovisual recording of the second community meeting available at foreriverhia.com;
- Public comment, including the Greater Boston Physicians for Social Responsibility reports from February, May and September 2019;
- MassDEP's Air Quality Plan Approval, January 11 2019;
- MassDEP Office of Appeals and Dispute Resolution's 'Recommended Final Decision (with Goodrich Exhibit B)', June 2019 and 'Recommended Final Decision on Reconsideration', August 2019; and
- MassDEP's (revised) Air Quality Plan Approval, August 26 2019.

2.4 Limitations of this Review

Every HIA is unique and requires a specific scope, a specific set of evidence, different levels of community health baseline information, different levels of analysis and assessment, and different levels of the development of mitigation and enhancement measures. Each HIA is therefore unique to a specific context, proposal and decision-making process. These issues speak to an inherent challenge in reviewing the quality of a HIA process and report by an external party that has not overseen the HIA process and is conducting a review after the HIA process took place. Despite this general limitation, this review report presents the best judgement by the reviewers on the quality of the HIA process and report using US and international good HIA practice guidelines as review criteria.

To provide a holistic understanding of the HIA process and its reporting, this review has considered the views of key stakeholders and those of the MAPC. In this regard, a specific limitation of this review was the inability of the reviewers to interview all members of the HIA team. The HIA team members from MassDEP and MDPH declined to be interviewed for this review because these agencies were part of an active litigation process linked to the HIA. This limited the reviewers' understanding of the HIA process and reporting from the perspectives of MassDEP and MDPH.

3. Findings of the HIA Evaluation

This chapter reports on the findings of the evaluation, including feedback from key stakeholders, findings from the evaluation of HIA-specific conditions and limitations and findings from the evaluation of the HIA process and report.

3.1 Feedback from key stakeholders

The feedback from key stakeholders is summarized in this section. Individual summaries were developed from written notes taken during each interview. These summaries were then sent to interviewees for their review and amendment. As some interviewees favored a summary of the feedback over having statements attributed to specific interviewees, and one interviewee was not able to confirm the summary, the feedback from the interviewees was summarized and synthesized into the key themes described below by the HIA evaluation team.

3.1.1 Feedback from community stakeholders

Interviews were conducted separately with four community stakeholders. Two of the interviewees were part of the HIA Advisory Committee. The following themes summarize the key feedback received.

The scope of the HIA

The community stakeholders judged that the HIA was not sufficiently comprehensive and that it wasn't sufficiently broad in scope. For them, an important limitation was that it did not consider many public health-relevant issues related to the proposed compressor station. Specifically:

- The HIA did not assess public safety-related health impacts linked to the proposed compressor station, e.g. fire and explosion that could result from placing a gas compressor station in a densely populated community setting. Addressing public safety-related issues were particularly important in light of recent incidents in compressor stations in the US. For example, the explosion of a similar type of facility in Michigan and the devastating explosions due to over-pressurization of the low-pressure distribution line system in the Merrimack Valley in Massachusetts. These incidents destroyed homes, sent dozens of people to hospital, and killed a young person. Furthermore, in the event of an explosion at the site of the proposed compressor station, the adjoining Fore River Bridge could become inaccessible, thus limiting access by emergency response teams and rendering evacuations very difficult given the limited ingress and egress to the area. In addition, a Massachusetts Water Resource Association (MWRA) sewerage pump station that handles millions of gallons of sewerage a day for surrounding communities abuts the proposed compressor station. The loss of such a regional utility could be disastrous for the community.

These omissions in the scope of the HIA were judged by community stakeholder's to be a key weakness.

- The HIA did not assess climate change-related health impacts linked to the proposed compressor station. The site of the proposed compressor station is a peninsula that is only a few feet above mean high water. There are tide and storm surges that can affect the project area, and there is a considerable risk of coastal flooding due to hurricane storm surges with important potential public health implications.
- The splitting of the assessment work, as per the Governor's Directive, across three sets of agencies was recognized as a key constraint for the HIA process and scope. In any case, the interviewed stakeholders considered that public safety-related health issues should have been considered in the HIA.

Community input and involvement

The community stakeholders considered that the HIA process did seek to include community inputs and feedback, i.e. feedback of the North Weymouth and South Quincy communities and from members of the HIA Advisory Committee, and that these inputs were prominently described in the HIA report. However, they judged that community views, inputs and concerns did not permeate meaningfully into the assessment process, nor to key sections of the HIA report. Most significantly, the interviewed stakeholders considered that community views, inputs and concerns appear to have had no impact on the HIA's final conclusions.

- The community engagement process, specifically the HIA Advisory Committee, was therefore judged by them to be tokenistic.
- Community stakeholders judged that there could have been more than two community engagement meetings, especially as one of them was held on a cold snowy night that may have limited attendance due to difficult travel conditions.
- The community concerns articulated during community meetings, about the use of the proponent's data, inputs, assumptions and estimates in the air quality dispersion modeling were judged by community stakeholders to be left unaddressed.
- Risks articulated by community stakeholders were considered to have been diminished to "perceived risks" and differentiated from other risks described in the report.
- The community stakeholders considered that the HIA team did not make a specific effort to engage environmental justice communities within the HIA focus area. Given the existing health burdens in these communities this additional outreach effort should have been considered.

Baseline data

The community stakeholders considered that additional baseline data should have been collected, specifically, independent data collected by individuals or organizations with no financial stake in the compressor station. For example, in terms of health outcomes, the HIA team should have collected data on low birth weight and developmental issues, such as

attention deficit hyperactivity disorder, in addition to the data that was collected on pre-term birth.

The community stakeholders noted that the baseline air quality data was collected by the Mass DEP for approximately three to four months. During that time, baseline air quality data exceeded Ambient Air Limits (AAL) and Threshold Exposure Limits (TELs). Therefore, this small window of a sampling time did not seem sufficient for stakeholders considering levels could change throughout the year.

Literature review

The community stakeholders judged that the snowball approach used to identify literature for the review of evidence was not systematic enough and did not include evidence on the impacts of air pollution on vulnerable communities. They pointed out that some of the evidence was almost 20 years old and some were from studies conducted in countries that were not similar to the USA or the local communities.

HIA methodology and methods of assessment

The community stakeholders considered that the methods for assessing certain health impacts associated with the proposed compressor station were weak, not sufficiently in-depth, or flawed. Some impacts were, therefore, not adequately characterized and assessed. Specifically:

- With regards to project-related emissions to air and their associated health impacts, the method of assessment used in the HIA and in the reporting of impacts was considered weak and flawed. Community stakeholders pointed out that compressor stations leak toxic chemicals in the course of daily operations and during maintenance. Community stakeholders cited the example of three chemicals – benzene, formaldehyde and 1-3-butadiene – that were likely to be emitted by the compressor station. These chemicals are human carcinogens acknowledged by regulatory bodies to cause cancer down to very low concentrations. Health outcomes associated with exposure to these chemicals include leukemia and other cancers. The failure of the HIA report to cover this aspect was considered by the community stakeholders to be a major gap.
- The rates of certain diseases in Weymouth and South Quincy are higher than in the rest of the State. Pre-existing high levels of air pollution in Weymouth and South Quincy contribute to the high rates of these diseases. Air pollutants that will be emitted by the proposed project will add to these pre-existing risks and increase them further. This issue of additive risks was judged by community stakeholders as not being appropriately considered in the assessment of health impacts.
- The community stakeholders judged that the HIA failed to consider cumulative risks. Background levels of air toxics already exceed state AELs and TELs in this area due to other industries and traffic. The benzene, 1,3-butadiene and formaldehyde expected

to be emitted from the compressor station would be added to air toxics already present.

- Community stakeholders judged that MassDEP disregarded the importance of some of the results of the air quality monitoring, specifically around the elevated concentrations of formaldehyde and benzene.
- Community stakeholders judged that an analysis of the contribution of the project emissions to cancer risk, non-cancer risk and all-cause mortality could have been undertaken.
- Community stakeholders judged that a more detailed analysis of air quality-related health impacts would have engendered more community trust in the inputs and outputs of the air quality modelling exercise and the overall assessment of air quality-related health impacts. Key aspects of this detailed analysis would have included a peer review of the methodology used to assess these impacts, and the air quality monitoring and modelling. An example of a weakness identified by the community stakeholders was the lack of consideration of how the geography of the proposed site could influence the dispersion of air pollutants, i.e. because the site is near water, this could lead to temperature inversions that can trap emitted pollutants lower to the ground for longer periods of time and therefore increase the level of exposure on local people.
- The community stakeholders considered that the HIA conclusions failed to draw from the evidence presented in the HIA report. The evidence presented in the HIA report articulated that there is a potential for health impacts to arise following exposure to ambient ozone, particulate matter less than 2.5 microns in diameter (PM_{2.5}), oxides of nitrogen (NO_x), and volatile organic compounds. However, the conclusions said that the impact of “perceived risks” would be higher than the direct air pollution impacts. There was no data presented in the report that showed “perceived risks” having more profound impacts than air pollution, and yet the report concluded that “perceived risks” are a greater risk to health than air pollution.
- The community stakeholders considered that thresholds and standards were not used consistently to judge the significance of air pollution health impacts and effects in particular. It seemed to them that the public health importance of some of the air quality results were not recognized, for example, the significance of health effects below regulatory standard levels for chemicals that had some adverse effect at all levels of emissions, i.e. had no threshold below which there was no adverse effect.
- The community stakeholders judged that the public health implications for users of the public park, located near the site, were not adequately considered in the HIA report. There was a sense in the community that a park was being lost, given the noise and air emissions. The HIA report failed to consider that members of local communities were likely to no longer use the conservation areas adjacent to the proposed compressor due to noise, noxious odors, and threat of accident. There was no discussion of replacement or compensation.

- The community stakeholders considered that the limitations of the data used in the HIA were not set out fully. For example, Behavioral Risk Factor Surveillance System data probably was not representative of environmental justice communities and had wide confidence intervals; air quality data didn't incorporate winter monitoring or account for air pollution spikes so exposures would be under-estimated.

HIA findings

The community stakeholders considered that the HIA recommendations implied that lifestyle factors such as smoking were to blame for the increased prevalence of key health outcomes in the project-affected communities. As no data was presented to support this assertion, community stakeholders felt that discussing lifestyle factors was unfounded and inappropriate. Rather, for community stakeholders, discussions of obesity and smoking rates and air pollution should have been framed in terms of additive or synergistic effects on health impacts. Some of the recommendations in the HIA report seemed therefore, to community stakeholders, to shift the responsibility for existing health burdens to local communities and local agencies. Community stakeholders stated that local communities have interpreted this as a way of dismissing their concerns rather than helping them.

Alternative sites

The community stakeholders considered that the HIA could have taken a more strategic approach. For example, one of the issues that needed further review as part of the HIA process was the assessment of alternative sites. While the EIA of the project included an assessment of alternative sites in terms of their potential impacts, it seemed that environmental issues were weighted more highly than the potential human health effects. Therefore, stakeholders considered that a more encompassing HIA could have been performed to find a proposed location that considered human health impacts and environmental factors much earlier in the process.

Health equity

The community stakeholders judged that the HIA did not sufficiently address health equity. The conclusions did not discuss the impacts of air pollution on vulnerable populations such as environmental justice communities, children, adults with underlying health conditions and the elderly. There is ample peer-reviewed evidence that these populations are likely to experience disproportionately worse environmental health conditions and will be impacted more severely by air pollution than healthy adults.

Resources

The community stakeholders judged that the short timeline available for MAPC, to lead the HIA, was a constraint, especially with the holiday season coming in the middle of the timeline. This made the process feel rushed and there seemed to not be enough time to give

considered answers and suggestions. The funding available for the HIA was also considered by them to be insufficient.

Other issues

The community stakeholders pointed out that neither the Advisory Committee nor other interested community stakeholders were given a chance to review the final draft of the HIA report before it was published.

The community stakeholders also judged that the relationship between MAPC, as a contractor responsible for leading the HIA, and MassDEP and MDPH, acting as both commissioners and funders of the HIA, and members of the HIA team, may have constrained the HIA process. For example, it was unclear whether MassDEP and MassDPH limited the scope of the HIA that MAPC led.

The community stakeholders believed that the members selected to be part of the advisory committee should have included more subject matter experts in air toxics and public health.

The community stakeholders considered that the HIA did not have much influence on the decision-making process. 'Health' did not have much authority in the permitting process as MassDEP has only a small remit/responsibility for health linked to the air quality permitting process.

The community stakeholders expressed concern about the possibility that the HIA report can set a precedent for future HIAs undertaken for similar projects. Specifically, community stakeholders were concerned that the findings of the HIA report could potentially be harmful to other communities of Massachusetts. For example, allowing the Governor's assessment of the HIA, 'that it is the highest quality HIA ever done on fossil fuel infrastructure', to go uncorrected, may pave the way for future fossil fuel HIAs to be conducted in the same manner.

3.1.2 Feedback from MAPC

A 45-75-minute interview was conducted separately with two representatives from MAPC. They identified the following key issues relating to the Weymouth Compressor HIA.

Contextual factors

The work of regional agencies involves managing objectives of municipal, state and federal agencies as well as community organizations, community groups and private businesses. In some cases, the objectives align well and work proceeds with those involved seeing mutual benefit. In other cases, each party has a different objective – or vision – for the work and in these cases, work can be extremely challenging as regional agencies seek to balance each

stakeholder's requirements while seeking to prevent harm. This is particularly true when there are proposals to introduce new elements – homes, business, roads, parks – into cities and towns. Although challenging, the work is very rewarding when collaborations, with mutual respect and co-operation and honest working relationships, can be developed during the process.

When MAPC undertook the HIA, the compressor station had already undergone a number of reviews and rounds of input, which had brought forth competing objectives. The proposal to build a compressor station also occurred in the context of several state and local efforts related to climate change, clean energy and environmental pollution – all of which also involved differing and sometimes competing goals. Undertaking the HIA was meant to provide a supplemental resource in the state's review of the proposal and made no attempt to preclude other processes and other types of assessments. Additionally, the HIA, as a supplemental resource, had no statutory standing in the regulatory decision-making context. That said, MAPC could not control how the Commonwealth might use the HIA once it was completed.

Objectives of the HIA

MAPC had a series of key objectives in undertaking the HIA:

6. Determining whether the compressor, under normal operating conditions, would damage public health in any measurable and significant ways.
7. Providing guidance on and then executing the scope of the HIA, consistent with their contract with MDPH and MassDEP;
8. Conducting the HIA in accordance with the Governor's Directive and consistent with good practice from the HIA field;
9. Bridging multiple fields to conduct the HIA (e.g., public health, environmental health, energy, land use and community planning); and
10. Engaging municipal and community stakeholders so that the HIA was based on findings that blended evidence and community voice.

For MAPC this was more than just a technical assessment. They hoped to engage in a process to demonstrate how public regulatory processes could integrate more local perspectives and community engagement for the purpose of more collaborative decision-making. MAPC recognized that this was the first HIA to be conducted in connection with an air permitting process of this kind, which very rarely involve this level of engagement and review. MAPC hoped the process could provide a starting point for more involvement and understanding of public health in such processes and believed staff at MDPH and MassDEP shared this hope.

Scope of the HIA

The HIA of the compressor was screened in as a result of the Governor's Directive. The state agencies, MDPH and MassDEP, were both involved in the HIA process and were the

responsible agencies named in the Governor's Directive. The scope of the HIA followed that it would not explicitly involve public safety and climate change resiliency, which were assigned to other state agencies (EOEEA and MA CZM). MAPC's role on the HIA was to provide objective guidance and management of the HIA process from scoping through reporting.

The actual scope of the HIA was determined through meetings with the Advisory Committee. The initial Advisory Committee meeting surfaced health issues of concern. At the second meeting, MAPC presented a draft proposal and then synthesized committee input, with recognition that public safety and climate change resiliency reviews would be conducted by other state agencies. Project advisors offered agreement on the scope, in regard to its three main topics (air quality, noise, and land use), although the Advisory Committee would have liked a wider scope incorporating public safety and climate change. However, the Governor's Directive, and the limited time and money, reduced the scope of what could be delivered.

Data quality

MAPC had familiarity and experience working with public health and environmental data. MAPC's expertise came from previous work on multiple HIAs and public health projects, specifically work on traffic-related air pollution near highways. Although MAPC had this experience, the specificity of the data involved in the compressor station HIA required MDPH and MassDEP to play lead roles in the collection and analysis of air quality and health data, respectively. MassDEP, the regulatory authority for air permit review, had the expertise to review and ensure the quality and accuracy of the air quality monitoring and modelling data. This included data that MassDEP collected during the HIA, data provided by the proponent of the compressor, and the data provided by citizen-led air quality monitoring. MDPH had the expertise in working with cancer datasets that were collected and analyzed for in the project area. In some cases, air quality and health data straddled expertise in both agencies (e.g., health effects of air pollution). In these cases, the agencies played a shared role in order to interpret and report back on the data.

Engaging communities

The aim of the Advisory Committee was to engage representatives of surrounding municipalities and community organizations that were already involved with the process related to the proposed compressor station. To form the Committee, the municipalities were asked to recommend representatives, including one from their health department, and the community organizations were asked to identify participants they would like to serve on the Committee. The intent was to have representatives that were recommended by their groups, that had knowledge relevant to the process and/or the proposal, and not selected by some other process.

Each Advisory Committee meeting had a slide in the presentation that reviewed the role of the Committee. Each meeting also featured a visual aide to show where the project team was

at in the process. Several of the meetings also involved segments that were intended to build common knowledge around technical terms, science and public health data so that the Committee and the project team were working from a shared understanding.

A challenge in engaging with the Advisory Committee was that many members seemed to have already decided that the compressor should not be sited in the proposed location (but seemed open to its placement in other, more rural locations). This was a challenge as HIAs, while not advocating for or against a change, operate under an assumption that the proposal will come to fruition, allowing the results of the HIA to be used to determine mitigation and other actions to reduce or address impacts. The project team recognized and respected those with pre-decided positions, but MAPC often had to clarify that we were looking to assess health impacts if the compressor were in fact built. Understandably, resulting discussions in the meetings may not always have been as productive as possible given this condition.

3.2 Evaluation of HIA-specific Conditions and Limitations

This section discusses the key HIA-specific conditions and limitations that constrained the HIA. These conditions and limitations were identified from a review of key documentation and interviews with key stakeholders. Following from the document reviews and the stakeholder interviews, the evaluation team identified five key HIA-specific conditions and limitations that constrained the Weymouth Compressor HIA:

- The Governor's Directive influencing the scope of the HIA by narrowing its focus to air quality-related impacts.
- The Governor's Directive splitting the assessment of health-relevant issues across three agencies.
- The contractor relationship between MAPC and MDPH.
- The air quality permitting process being the main decision point that the HIA aimed to influence.
- MassDEP's long-standing approach to its air quality-related regulatory and permitting responsibility that is not aligned with the broader approach, and ethos, that a HIA should follow to assessing and managing health impacts.

These conditions and limitations are discussed below in terms of how they influenced the scope and the assessment methodology of the HIA.

3.2.1 Conditions and limitations that influenced the scope of the HIA

The first condition that constrained the HIA was that the Governor's Directive focused the scope of the HIA on the air quality impacts of the project on the public's health. The Directive also stated that the main decision-making process that the HIA would inform was the air quality permitting process under the authority of MassDEP. The HIA would therefore not be

feeding into a broader development or spatial planning consent process which is what usually happens to HIAs in the USA and internationally.

The second condition that constrained the HIA was the splitting of how the key community concerns (health impact, public safety issues and climate change considerations) would be addressed across three different agencies, which occurred as a direct result of the Governor's Directive. With no explicit mandate for MAPC to require the other two agencies to produce their reports, or to collaborate with MAPC, it was impossible for MAPC to ensure that all three concerns acknowledged in the Directive were addressed in a complementary way that either cross-referenced impacts across the three reports or produced a single consolidated report. This contextual constraint further contributed to the narrow scope of the HIA from the start of the process. This led to some confusion of the scope, and then later distrust of the HIA team, by community stakeholders. It is worth noting that it is not standard international HIA practice to set the scope of a HIA upfront or to split key health impacts that a HIA should address across various agencies. The splitting of the assessment of these three concerns across three sets of agencies was a key constraint acknowledged by some community stakeholders interviewed as part of this evaluation.

There is a strong sense from the report, and from discussions with MAPC stakeholders who were interviewed, that it was assumed, in good faith, that the *Public Safety Threat Review* and the *Climate Resilience Review* would be undertaken or facilitated by different state actors, as directed by the Governor. Therefore, the HIA team considered it appropriate to not include in the scope of the HIA an assessment of public safety- and climate change-related health impacts. The Office of Coastal Zone Management determined in November 2019 that the project meets Massachusetts standards for coastline development in a decision known as a federal consistency review.¹ It is unclear what review was undertaken on public safety risks.²

The third condition that constrained the HIA was that the Governor had directed MassDEP and MDPH to undertake the HIA. Therefore, MassDEP, MDPH and MAPC did not have an equal relationship in the process and reporting of the HIA. It is possible that MassDEP, and to a lesser extent MDPH, having a supervisory role in the how the HIA was undertaken, could have constrained what MAPC could scope into and consider in the HIA. To understand this more clearly it would have been helpful for the evaluation team (authors of this review report) to have had the opportunity to interview MassDEP and MDPH to understand their role in shaping the HIA scope, methodology and process. However, MassDEP and MDPH deemed this not possible due to the agencies being part of an active litigation process linked to the

¹ The Massachusetts Office of Coastal Zone Management (CZM) implements the federal consistency review process in Massachusetts. Federal consistency review is required for most projects that: 1) are in or can reasonably be expected to affect a use or resource of the Massachusetts coastal zone, and/or 2) require federal licenses or permits, receive certain federal funds, are a direct action of a federal agency, or are part of outer continental shelf plans for exploration, development, and production.

² On October 2 2019, the Weymouth Emergency Planning Committee Meeting included a public safety discussion regarding the proposed compressor station. It is unclear whether a formal review of public safety issues related to the proposed compressor station took place or if findings from such review were documented in any public document.

HIA. Furthermore, MAPC was in a contractual relationship with MDPH, with a fixed budget and timeline, which was likely to have also constrained the freedom MAPC had in relation to the scope, methodology and process of the HIA.

Another condition that constrained the HIA was having the air quality permitting process as the main decision point that the HIA aimed to inform, rather than a wider spatial and development planning consent process. This is worth noting because for the other two reviews, requested in the Governor's Directive, there is no mention of the reviews informing any regulatory or other decision-making process. This constraint influenced how the primary set of recommendations, developed as part of the HIA, were framed. These would have to be recommendations for conditions to be included in the air quality permit, should one be issued, and were therefore constrained in scope.

3.2.2 Conditions and limitations that influenced the assessment approach

The HIA was the joint responsibility of the MassDEP and MDPH, as per the Governor's Directive. This may have generated differences in perspective on the focus and aim of the HIA as well as the selection of the specific assessment approach used to assess impacts.

MassDEP is an agency of the Commonwealth of Massachusetts responsible for protecting the environment in the state and has clear regulatory and permitting functions linked to industrial facilities. As stated in the HIA report, MassDEP in accordance with its air pollution control regulations must determine if the proposed facility will meet all applicable regulatory requirements. If a proposal meets these requirements, then MassDEP must permit the facility. In addition, for air quality permitting, MassDEP has a long-standing practice of requiring air quality modeling to assess only those ambient air quality changes that are caused by a proposed project without taking into account existing background levels. This practice by MassDEP of assessing impacts permeated into the assessment approach used in the HIA to appraising potential physical health effects from changes in air quality. However, this practice is not aligned with standard practice in HIA, where background/baseline levels of air pollution must be considered when assessing and rating impacts.

While there is not a conflict of interest in MassDEP performing its regulatory and permitting function alongside undertaking a HIA, it does have the potential to generate tensions. This is because MassDEP could find itself undertaking a HIA - based on a broader public health approach and not solely on compliance with regulatory thresholds - that could judge a proposed project to have significant public health impacts while still having to issue a permit to a project because it complied with regulatory standards.

3.3 Evaluation of the HIA Process and Report

This section reports on the findings of the evaluation of the HIA process and report. It is organized by themes that bring together relevant criteria of the HIA review framework developed for this evaluation. Where appropriate, findings from the stakeholder feedback and evaluation of the HIA-specific conditions and limitations are discussed.

3.3.1 Wider contextual information

The HIA report provides sufficient wider contextual information on the HIA. It explains how the HIA was commissioned following the issuance by Governor Charlie Baker of a directive, dated July 2017. This directive was issued in response to mounting concerns from communities near the proposed project site, civil society organizations, local authorities and elected officials on the potential impacts associated with the project.

The Governor's directive was structured around three specific assessments that were to be undertaken by three different state agencies: "Assessing Air Quality Impacts on Public Health" would be the responsibility of MDPH and MassDEP, the "Public Safety Threat Review" would be led by the Secretary of Public Safety and the Secretary of Energy and Environmental Affairs³, and the "Climate Resilience Review" would be led by the Massachusetts Office of Coastal Zone Management⁴.

The directive charged MassDEP and MDPH to jointly prepare a "public health impacts assessment" to "document the current background air levels at the site and the current health status of the community", to "consider the future air quality impacts of the proposed project on public health", and to complete this assessment prior to the issuance of any air permits by the Department of Environmental Protection". In March 2018, MDPH contracted with the MAPC to facilitate the HIA for the proposed natural gas transmission compressor station in Weymouth. Jointly, the MDPH, MassDEP, and MAPC formed the HIA project team.

This aspect is judged by the evaluation team, overall, to be adequately covered in the HIA report. According to good practice, and especially given the HIA was commissioned and authored by public sector agencies, it would have been worthwhile to have included the names and affiliations of the HIA authors. Though, it is worth noting, that in international practice, HIAs can have authors' names specifically listed or they may only have the names of the organizations who undertook or commissioned the HIAs.

³ The Secretary of Public Safety and the Secretary of Energy and Environmental Affairs were directed to facilitate an opportunity for the public to bring their concerns directly to the federal Department of Transportation's Pipeline and Hazardous Materials Safety Administration.

⁴ The Massachusetts Office of Coastal Zone Management was directed to review the project's safety and reliability under coastal storm conditions, taking into account rising sea levels.

3.3.2 Description of the site and project

The HIA report provides sufficient information about the proposed site, its current use and how this will change should the project move forward. Furthermore, the HIA report provides sufficient information on the surrounding area and its different uses. Likewise, sufficient detail about the project, its objectives, design and size, and expected project-related activities during the construction and operation stages is provided in the report. The information provided in the HIA report enables a good prediction of potential community health impacts throughout the lifecycle of the project. This aspect is judged by the evaluation team, overall, to be adequately covered in the HIA report.

An aspect that could have been strengthened in the HIA report was the description of the decommissioning phase for the project. A description of all project phases is good practice in impact assessment. However, in the context of both HIA, as well as other forms of impact assessment, such as Environmental Impact Assessment (EIA), limited detail is often provided in the description of decommissioning activities. This is because decommissioning is often likely to take place many decades in the future and the decommissioning activities may change, as the operating activities change. It is often assumed that the potential impacts associated with decommissioning activities tend to be in line with those identified for the construction stage. Also, it is often proposed that an impact assessment or management plan will be developed for such decommissioning activities when a decision to decommission is being considered.

Another aspect that could have been strengthened in the HIA report was a consideration of alternatives to the proposed project. According to good practice, alternative siting or technology options, i.e. a do-nothing option and other possible sites and other technologies that could be used for the proposed project, should be described. The potential benefits and costs to human health of the proposed project are then compared to the alternative siting and technology options identified. While it is recognized as good practice, an assessment of alternatives is commonly not undertaken in HIAs internationally, i.e. it is a common gap or weakness in practice. This is because the assessment of alternatives is most often included in some other forms of impact assessment, such as EIA, and HIAs generally cross-refer to the alternative options assessment in these other assessments. The EIA undertaken for the Atlantic Bridge Project⁵ which includes the proposed gas compressor station in Weymouth included an assessment of alternatives. This alongside the contextual factors driving this HIA, i.e. that it took place following a very specific directive to assess the potential public health impacts of the proposed project on a specific location, can explain the limited coverage of this aspect in the HIA report.

⁵ Atlantic Bridge Project Environmental Assessment. May 2016.

3.3.3 Description of the policy, legal and regulatory framework

The HIA report provides relevant information on the key aspects of the policy, legal and regulatory framework relating to the health impacts that were scoped into the HIA: air quality, noise and land use/natural resources. It also considered the proposed project's alignment with this framework. Details are provided on regulatory aspects relating to the proposed project, the regulatory reviews and permits that the project is subjected to and makes reference to a number of relevant policies and standards. This included noise policy, e.g. MassDOT's Type I and Type II Noise Abatement Policy and Procedures, and air quality standards, e.g. MassDEP's Allowable Ambient Limits and Threshold Effects Exposure Limits, and the National Ambient Air Quality Standards. This aspect is judged by the evaluation team, overall, to be sufficiently covered in the HIA report.

An aspect that could have been strengthened in the HIA report, was a broader description or consideration of the public health policy, legal and regulatory framework. The HIA report does not provide details of any specific municipal or state health-focused policies aimed primarily at protecting or promoting wellbeing and public health and reduction of health inequalities, nor how/if the proposed project is aligned or accords with the aims of such policies. If there were no relevant health focused policies applicable to this project, or the HIA, beyond those described for air quality and noise, then this could have been explicitly stated.

3.3.4 The governance framework and process for the HIA

The HIA report provides sufficient detail on the governance framework and process that was followed during the HIA study. This includes a description of the lead agencies responsible for conducting the HIA study, their roles, the establishment of a HIA advisory committee, how this committee functioned and its membership. The Advisory Committee's roles and responsibilities were to advise the project team during all phases of the HIA, e.g. scoping the HIA, assessment of health impacts, development of mitigation and enhancement measures, and to share their expertise and comments on the project and the HIA. The Advisory Committee met seven times throughout the HIA process, between June 14, 2018 and November 28, 2018. The purpose of each advisory committee meeting is described, and these covered the key steps of the HIA, namely scoping, assessment of impacts and development of recommendations. This aspect is judged by the evaluation team, overall, to be sufficiently covered in the HIA process and report.

An aspect that could have been strengthened was allowing the Advisory Committee to review and provide comments on the final HIA report before it was published. This lack of scrutiny coupled with disagreements on the scope, methodology and findings of the impact assessment resulted in no ownership of the HIA by the advisory committee. Weaknesses on the effectiveness of the governance framework and process are elaborated in Section 3.3.10 on the stakeholder engagement process.

3.3.5 The scoping process and scope of the HIA

The scoping process, and the methods used during the process, are clearly described in the HIA report. MDPH, MassDEP, and MAPC led the scoping process, with inputs from the HIA Advisory Committee and members of the community. The scoping process identified seven themes of high concern to local communities for the HIA to consider. These potential health impact pathways that are changed by the proposed compressor station are provided in Figure 3 of the HIA report. The assessment scope of the HIA is also described in the HIA report. This includes a clear explanation of the geographical area of interest, existing sensitive⁶ groups, and which health impact pathways were selected as the focus of the HIA. However, some key issues raised by the community relating to the public safety- and climate change-related impacts of the proposed project were not considered. This aspect is judged by the evaluation team, overall, to be a weakness that could have been strengthened.

Having said the above, it is clear that the Governor's Directive was a key consideration in the narrowing of the scope of the HIA. Two other state agencies had been mandated to undertake separate and parallel reviews of the compressor station's public safety- and climate change-related impacts. In this context, the decision by the HIA team to not include these issues in the scope of the HIA is defensible. However, given the local communities' and other stakeholders' strong concerns about public safety- and climate change-related impacts MAPC could have used a number of alternative approaches to address this challenge in the scope of the HIA, see Chapter 5.

In addition, more detailed justification for the health impact pathways that were scoped out of the assessment, especially those that were of high concern for local communities and the HIA Advisory Committee (public safety and climate change issues), should have been presented.

3.3.6 The baseline health profile

The health baseline profile of local communities was described in the HIA report and was in line with international HIA practice. It provides sufficient information to gain an appreciation of the key existing community health issues, the existing health status of local communities and the state of key determinants of health that were relevant for the health impact pathways that were scoped into the HIA. It is considered that the community health profile of affected communities and groups, as described in the HIA report, has an appropriate level of comprehensiveness and detail. It is further considered that the community health profile can

⁶ For simplicity sensitive groups is used to mean the same as sensitive, vulnerable and disadvantaged groups.

support the appropriate identification, analysis and prioritization of both positive and negative health impacts and effects potentially associated with the proposed project. The HIA report describes the methodology used for gathering and analyzing health profile data, the datasets used, the dates the data were published, the geographical areas they were for, the population groups that were profiled, if data applied to sensitive groups e.g. pediatric asthma prevalence, and what inequalities in health there were across different geographical areas. This aspect is judged by the evaluation team, overall, to be sufficiently covered in the HIA report.

Future trends in local communities' health were not described. However, this aspect is often not explicitly described in HIA reports and it is often assumed, implicitly or explicitly, that health profile trends will remain as they currently are. This is often because there is limited information to make an accurate prediction.

While health inequalities are described, health equity issues are not described in the HIA report. While in theory HIAs are particularly concerned with promoting health equity, as stated on the HIA report (page 8: "HIA has a particular emphasis on health equity, or how a policy or project may impact existing health inequities..."), in practice baseline health profiles often tend to keep to a description of health inequalities, i.e. differences in the health status of different population groups. Equity, or inequity, health issues, as opposed to equality, or inequality, issues require a judgement on fairness, or unfairness, around any existing systematic health disparities and this can be deemed subjective and debatable. It is probably for this reason that most HIAs tend to focus on inequalities rather than inequities when describing the baseline health profile of affected communities. This aspect could have been strengthened by providing a commentary on existing health inequalities, and where these could represent possible health inequities.

3.3.7 The evidence used in the HIA

The breadth and depth of evidence collected and described in the HIA report is sufficient, balanced and of good quality. It includes evidence from literature reviews, stakeholder opinions and experiences, and technical data, where relevant, to inform the analysis and prioritization of health impacts. The HIA report describes how stakeholder, including community, knowledge and experience was sought and considered, the methods for stakeholder and community engagement, the range of stakeholders and how many people from different groups were engaged. With regards to scientific literature and evidence, the HIA report provides a literature review search strategy that is clear, the methodology and sources used are judged to be relevant and appropriate for the project and in line with acceptable practice. The snowball approach complemented by literature identified by key informants, in this case HIA Advisory Committee members, is judged to be adequate. The

description of the specific evidence base on the three health impact pathways scoped into the HIA is provided under specific sections (pages 65-72, 112-117, and 132-138) and judged to be balanced and comprehensive. Overall, the HIA report uses evidence that is up to date, of a high quality, and from different independent and trustworthy sources. The report sets out the limitations of the evidence collected. This aspect is judged by the evaluation team, overall, to be adequately covered in the HIA process and report.

It is, though, important to note here that some of the evidence that is cited in the HIA report was not given sufficient weight in the analysis of impacts. More weight was given to evidence on health effects in relation to regulatory thresholds. From a HIA perspective equal weight should have been given to non-threshold health effects, i.e. the health effects below regulatory thresholds of changes to air quality and noise as well as existing levels of pollution and the existing health status of project-affected communities. Non-threshold effects are health effects that occur at all levels of exposure both large and small. These non-threshold health effects should have been considered and their significance analyzed, particularly, when they occur across a large number of people.

3.3.8 Identification, characterization and assessment of health impacts

The general assessment methodology described in the HIA report, including the procedures, methods and tools used for the assessment of health impacts, as described on pages 22-26 and 61-62 of the HIA report, is appropriate and in line with international HIA practice. The discussion on the identification of potential health impacts is transparent and detailed. The illustration of health impact pathways is also clear, detailed and well structured.

The specific methods and tools used in the assessment of each of the three themes (air quality, noise and land use) are described in the respective assessment sections (pages 64-65, 111-112, and 132, respectively). Some aspects of the methods and tools used for some of the themes could have been strengthened, specifically for the air quality-related health effects as described in greater detail later on in this section and on appendix 4.

While the methodology of the HIA, as described on pages 22-26 of the HIA report, suggests an approach that will take account of a wide range of issues when characterizing and analyzing the identified health impacts, this does not seem to have been the case. Instead, for key health impact pathways, the determination of significance, has relied solely on a comparison against regulatory thresholds, see later sub-section, *3.3.8.1 Health effects from changes to ambient air quality* and *3.3.8.2 Health effects from changes to the noise environment*, for more details. This aspect is judged by the evaluation team, overall, to be a weakness and needed strengthening in the HIA process and report.

An additional aspect that was evaluated was whether the use of quantitative methods for estimating some health effects could have been useful in this HIA. Quantitative methods for

estimating the health effects associated with changes in air quality and noise are available, though they are not routinely used in HIAs. The use of quantitative methods in project-level impact assessments should be considered with caution. Among other reasons, such as resource requirements, the application of quantitative methods for estimating health impacts at the level of small populations that are often considered in project-level impact assessments can be less valid when compared to their application to larger populations. On balance, the HIA evaluation team considers that in the case of the Weymouth Compressor Station HIA, the use of quantitative methods would have been useful. This is because the scope of the HIA was clearly focused on air quality and noise-related impacts and there was considerable community concern about the air quality-related health effects the project could cause. The estimation of project-attributable health risks and health effects would have helped to identify the implications of existing levels of air pollution compared to the additional implications of the proposed project. It may also have helped better communicate the likely health risks of existing and future levels of air pollution and noise. This may then have enabled a clearer dialogue between the HIA team, the HIA Advisory Committee, the local communities and other stakeholders on the magnitude and significance of the health effects of the existing and future changes in air quality and noise.

As discussed previously, in Section 3.3.6 on the health baseline profile, while HIAs tend to be particularly concerned with health equity and how this can be affected by a project, in practice, HIAs tend to focus more on the distribution of impacts and effects and how project-related health impacts may exacerbate inequalities rather than inequities. The HIA report provided no commentary on the potential for the project to exacerbate inequities, except for the comment on page 151 where it reads, with regards to land use and natural resources, that:

...There are vulnerable populations who could be more susceptible to other mechanisms of health impacts from changes in the land use and natural resources. These include people of color and people with lower incomes who can already experience health inequities and along with others, may experience a reduced feeling of ownership or control of the area given the opposition to the proposed station...

A commentary on health inequities could have been provided on air quality health impacts. This is because existing levels of some air pollutants are higher, and for some pollutants are above regulatory thresholds, in the project-affected communities compared to the state average. The project is expected to place an additional exposure and risk on affected communities, therefore possibly exacerbating an existing inequality. This, in turn, could be construed as further increasing inequities in health, that is being unfair and avoidable by reasonable action.

The following sub-sections provide a review of the discussion on the health effects from changes to air quality and noise as reported in the HIA report. A more detailed review of these two health impact pathways is provided in Appendix 4.

3.3.8.1 Health effects from changes to ambient air quality

A key health impact pathway identified and assessed in the HIA was “Air Quality-related Health Impacts”. Though the methodology used to analyze the impacts, as described in Part 2 of the HIA report (page 22), was broad and in line with international HIA practice, the specific method of analysis that was ultimately used to characterize and analyze air quality-related health impacts was narrow.

The method of analysis used to characterize and assess potential health effects associated with project-attributable changes to ambient air quality during the operation phase is described as qualitative and focused on a comparison to MassDEP’s Allowable Ambient Limits (AALs), Threshold Effects Exposure Limits (TELEs) and EPA’s National Ambient Air Quality Standards (NAAQS). This method of analysis, comparing the predicted/modelled contributions of the compressor station to air pollution levels against MassDEP’s TEL/AAL and EPA’s NAAQS, was narrow and is more often used in Environmental Impact Assessments and permitting assessments. As applied and described in the report, this method of assessment does not take account of wider considerations. For example, the scientific evidence on the no threshold effects of air pollution, the existing high levels of exposure to air pollution in affected communities (the focus area), or the existing health burdens of project-affected populations that are important considerations for the assessment of this potential health effect.

HIAs in general tend to assess impacts mostly based on a qualitative professional judgement, even though this judgement is often informed by outputs of quantitative methods, such as air quality modelling, undertaken as part of an EIA. However, in many HIAs, this qualitative professional judgement is often not sufficiently reported or is reported using a narrow physical biomedical approach, rather than a broad public health approach. Assigning significance to a health impact in an HIA should not be formulaic or mechanistic, based on a computation of magnitude vs. sensitivity or similar variables, but rather on a narrative description of all considerations that have informed the judgement on significance. A broader rather than a narrow approach would have been better suited for analyzing the health impact pathways identified in the HIA report.

In addition, some air quality statements made in the HIA report while valid from a regulatory perspective can be open to discussion from a scientific and public health perspective. These statements are often not fully understood by different audiences and need to be used with care. An example of such a statement is “Thresholds that have been established as health protective are used in regulatory processes in order to assess how new projects may impact

health” (page 108). Such statements are often found in EIA reporting, and sometimes in HIA reporting. While valid from a regulatory perspective, this statement can be scientifically misleading and can be used inappropriately as justification for saying that there is an absence of adverse effects below regulatory thresholds. A more accurate description would be that thresholds have been established following an administrative process, standards setting, that is science and health based. For example in the US based on EPA’s Integrated Science Assessments. They reflect a level that is considered to be ‘safe enough’ i.e. an acceptable level of risk from a societal perspective balancing social, economic and environmental factors.

It is widely accepted that for various pollutants there is no concentration level below which health effects cease to occur at the population level. For other pollutants, health effects are known to occur at concentration levels below regulatory thresholds. Therefore, while compliance with regulatory thresholds is commonly used in EIA, and sometimes in HIA, as a sufficient (‘good enough’) proxy for assessing health impacts, it should not be stated, or implied, that such compliance is equivalent to the absence of health effects as this is unlikely to be true for all or many situations.

In the case of this HIA, it was further stated that “potential health impacts [can occur only] if such exposures exceed health standards or guidelines [and] that operation of the station is estimated to (...) result in concentrations below NAAQS and air toxics that will not contribute concentrations above TELs and AALs [therefore] there are neither positive nor negative health effects expected as estimated emission levels are less than health protective standards and guidelines.” As described above, it can be argued that this reasoning is only accurate from a narrow regulatory thresholds-based perspective. For example, for PM_{2.5} there is no concentration level, threshold, below which health effects cease to occur. Any increase in PM_{2.5} concentrations can lead to a health effect at the population level. This means that the discussion and characterization should then be around the likely magnitude of the effect. The same argument can be made around hazardous air pollutants and volatile organic compounds that have no threshold effects. Any emission of these pollutants to air would entail some health risk. This magnitude tends to be on the level of *negligible*⁷ to *small* or within acceptable levels of risk, in most cases. That is, in the context of infrastructure projects in high income countries using best available project technologies and pollution control technologies, and with appropriate levels of regulatory enforcement. The concluding statements in the HIA report can therefore be argued to be a narrow regulatory thresholds-based interpretation of the scientific and public health evidence.

3.3.8.2 Health effects from changes to the noise environment

⁷ *Negligible*, in impact assessments, can be understood as resulting in a magnitude of effect that is indistinguishable from normal variations in the outcomes of interest, such as daily variations in rates of hospital admissions or non-accidental mortality, and acceptable levels of risk linked to carcinogenic effects

A key health impact pathway identified and assessed in the HIA was “Noise-related Health Impacts”. The HIA report concluded that noise-related health impacts during operation are neutral, unlikely, and of very low magnitude. There seem to be inconsistencies in the reporting of the reasoning behind these conclusions, specifically around the indicators used and subsequent comparisons made to regulatory thresholds, recommended by the EPA, and/or guidelines values, recommended by the WHO. The HIA report presents the current noise levels using different indicators, which makes it difficult to follow throughout the text. These indicators are different to those used as thresholds by the EPA and by the WHO. The HIA report also presents the future estimated noise environment, with the project in operation, again using different indicators to those used by the EPA and by the WHO. For example, comparisons are made between daytime noise levels and $L_{eq(24)}$ or L_{dn} thresholds.

The HIA report also states that “the increased outdoor sound levels from normal operations are not estimated to be at a level or exist for extended periods of time that would cause annoyance (i.e., not exceed 55 dB(A)).” (page 130 of the HIA report). This statement is an oversimplification. The evidence on environmental noise annoyance, for example as explained in Guski et al (2017)⁸ shows that environmental noise annoyance occurs at lower levels of exposure. In the case of the recent setting of the WHO guideline values, the threshold of 53 dB for annoyance, linked to road traffic noise, reflects an absolute risk of high annoyance of 10% of the exposed population which was considered in the WHO guidelines as the relevant level of risk that should not be exceeded, i.e. even though some people are affected by lower levels of noise, this level was judged to be sufficiently protective of public health. The guidelines also state that there was an increased risk for annoyance below this noise exposure level. For example, 9% of the population would report being highly annoyed with an exposure level of 40 dB L_{den} , but probably there would be no increased risk for other health outcomes. An alternative statement that could have been used in the report was that the increased outdoor sound levels from normal operations are not estimated to be at a level that would be expected to be associated with considerable levels of annoyance, followed by an explanation of what is judged to be ‘considerable’ and how this is rooted in established public health evidence and practice.

The same point can be made on the nighttime noise levels. The WHO night noise guidelines (WHO, 2009), concluded that there were observed adverse health effects at levels starting from 40 dB L_{night} . At 40 dB, about 3–4% of the population, depending on the noise source, reported being highly sleep-disturbed due to noise, which was considered relevant to health. In setting the new night noise guidelines values, it was agreed that the absolute risk associated with the guideline value selected should not exceed 3% of the population that reported being highly sleep disturbed, i.e. this level was judged to be sufficiently protective of public health.

⁸ Rainer Guski, et al. “WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Annoyance.” *International Journal of Environmental Research and Public Health*, vol. 14, no. 12, MDPI AG, 2017, doi:10.3390/ijerph14121539.

A further aspect noted from the review of the Physicians for Social Responsibility report was that night-time noise values in some locations were already above guideline values and that the project would contribute to further exacerbate this exposure. While this seems to be the case, the evaluation team would argue that in the context of HIA, this effect would be felt for a small population and based on a small exposure which would, at the population level, likely result in a small health effect contributing a small amount to the additional risk of noise-related health outcomes. Nonetheless, given the breach of regulatory thresholds, this aspect should have led to the development of mitigation measures for those residents affected. For example, through the use of landscaping to create embankments and the installation of additional noise screening at the fence line or window glazing at the affected properties to ensure the noise levels would remain below thresholds.

3.3.9 The recommendations of the HIA

Overall, this aspect could have been strengthened. The HIA report provides three sets of recommendations: (i) 'potential actions related to the proposed compressor station'; (ii) potential actions related to existing 'environmental and health conditions' that were identified through the HIA; and (iii) a number of 'other community recommendations' proposed by the HIA Advisory Committee members and other community members.

The 'potential actions related to the proposed compressor station' are the main set of recommendations made in the HIA report. The MassDEP, in accordance with its air pollution control regulations, must determine if the proposed facility will meet all applicable regulatory requirements. If a proposal meets all requirements, then MassDEP must permit the facility. Though, MassDEP may include permit conditions on its approval. The main set of recommendations therefore focused on mitigation and enhancement measures that could be taken up by MassDEP as part of the permitting process. Taking into account the constraints of the permitting process, the evaluation team judged that, overall, the main set of recommendations, were a reasonable and appropriate set of mitigation and enhancement measures.

However, the level of commitment by MassDEP to incorporating these recommendations into the air permit was not clear. The initial air permit issued January 2019, one week after the HIA report was published, stated that the results of the HIA report were considered in setting the conditions for approval. However, these conditions do not seem to have included all the recommendations in the HIA report. Following an appeal, some other recommendations of the HIA report were included, although seemingly still not all.

The second set of potential actions related to existing 'environmental and health conditions', that were identified through the HIA, was developed as secondary recommendations. These secondary recommendations focused on wider environmental and health conditions and

were not related to potential impacts from the proposed project. Although this second set of recommendations was seen by the HIA Team as an opportunity to positively, and proactively, address existing environmental and health needs, only one of them was relevant and appropriate to the focus of the HIA; the need for additional air quality monitoring. Of the other three recommendations one focused on an environmental aspect that was not relevant to the project; radon in homes. The other two focused on the individual level behaviors of local community residents: reducing tobacco smoking, increasing physical activity and healthy diets, and supporting the better management and treatment of respiratory conditions, particularly in children. Given the concerns of local communities and the HIA Advisory Committee, these recommendations unfortunately gave the impression to community stakeholders that the fault and responsibility for the existing health issues in the project-affected communities was mainly linked to individual behaviors or 'lifestyle choices'. Though the HIA Team did not intend it in this way, they come across as a form of 'victim blaming'. This is a recognized issue in public health theory and practice where individual level behaviors are seen as solely linked to a person's free choice, rather than also being linked to the wider social, cultural, economic and environmental factors such as poverty, unsafe neighborhoods, poor quality and insecure employment, and existing environmental and social burdens.

The third set of recommendations presented in the HIA report in a box headed 'Community perspectives: recommendations' presented the additional set of "other community recommendations" that were not "used to develop the potential actions in the report" (i.e. the first set). While the inclusion in the HIA report of this third set of other community recommendations by the HIA team was again done in good faith, in the spirit of transparency and with the intention of not losing out on meaningful community feedback (and in this sense it is a notable positive practice), it had the unintended effect of appearing to community stakeholders to be undercutting and delegitimizing what were reasonable mitigation and enhancement measures.

As an alternative to the three sets of recommendations developed by the HIA team, two sets of recommendations could have been developed: a core and wider set of recommendations. The first set of recommendations, the 'potential actions related to the proposed compressor station' would have been termed 'the core set of recommendations' as they focused on actions that fit within the regulatory framework of the air quality permitting process. It would have been explicitly stated that this was their purpose. The second, termed, 'wider set of recommendations' would have included recommendations, not constrained by the air quality permitting process, reflecting the full range of mitigation and enhancement measures developed by the HIA team, by the HIA Advisory Committee and by community members. This would still have needed to exclude the recommendations focusing on individual behaviors.

3.3.10 The stakeholder engagement process

The report included a clear explanation of how local communities and sensitive groups and other NGO, business, and governmental stakeholders were consulted and engaged in the HIA process. It described meetings, HIA Advisory Committee meetings and community meetings, discussions over the phone, via email and via the project website. Meetings were facilitated by HIA team members and assistance from municipal staff in Quincy, Braintree, and Weymouth. The report describes how the stakeholder groups, key informants, other stakeholders and citizens who might have participated in the HIA got involved, explaining the engagement methods and their timing. A brief description is provided of the community meeting held on June 20, 2018 to share information about the HIA process and request input from residents and other stakeholders, its structure, process and purpose (page 19 of the HIA report). The report identifies the relevant stakeholder groups that were involved in the HIA. The report acknowledges the involvement of residents and other stakeholders who joined the HIA Advisory Committee and participated in the community meetings and provided feedback to the HIA Team. The stakeholder engagement process - the HIA Advisory Committee, the two community meetings, the website, emails and phone calls - did identify all the main community concerns and achieved the main objective of what a stakeholder engagement process should achieve in a HIA. This aspect, overall, was judged by the evaluation team, to be adequately covered in the HIA process and report.

A number of aspects could have been strengthened. Firstly, further details could have been provided on who took part in the community meetings and the actual feedback received from these meetings. Secondly, it could have clearer how the feedback and evidence generated through the stakeholder engagement process were used in the HIA. This is because while stakeholders were consulted, from the evaluation team's perspective, this seemed to have limited influence on the methods of assessment, and findings and recommendations of the HIA. Thirdly, some community stakeholders also felt that more community consultation was warranted, particularly of sensitive communities, and that the approach to the community meetings could have been improved.

The HIA report describes how the community engagement was mostly a two-way information sharing exercise. The report does not explicitly describe how stakeholder feedback informed the final set of health impact pathways chosen, how they informed the analysis of significance and prioritization of specific health impacts, and how they informed the development of the recommendations.

The HIA report does though document the feedback received from the HIA Advisory Committee members and an analysis of the comments to identify priority issues, and the expectations and concerns that these stakeholders had. It also sets out the recommendations that the Advisory Committee identified should the project go ahead. The evaluation team considered the highlighted boxes setting out community views as a positive aspect of the HIA,

though as discussed in the previous section, this was not how some community stakeholders saw this.

It is unclear from the HIA report whether key vulnerable groups were consulted and engaged, specifically residents or representatives from the two environmental justice neighborhoods that are within the project study area, Quincy Point and Germantown neighborhoods on the Quincy side of the Fore River. According to feedback received from community stakeholder interviewees, representatives from these sensitive communities were not engaged during the HIA process. While the two community meetings were open to the public, it is unclear whether there was participation by residents or representatives from the two environmental justice neighborhoods and it seems that there was no specific outreach effort to engage these communities as part of the HIA process.

Feedback from the community stakeholder interviews was that the engagement was one-way providing information on the HIA to communities and gathering information for the HIA. The interviewed Advisory Committee members expected a more equal two-way dialogue, i.e. for the advice that they provided to have a greater influence on the HIA process and report. This was also reflected in all the stakeholders that were interviewed feeling that the HIA Advisory Committee should have had an opportunity to review the draft findings of the HIA and feed into the development of the findings and mitigation and enhancement measures. One of the stakeholders interviewed also raised the issue that though the community concerns and recommendations were in the final report, because they were not part of the main analysis and recommendations of the HIA, they had no standing and appeared to be a token gesture to community stakeholders.

3.3.11 Reporting and communication of findings

The information, evidence and analysis is logically arranged in chapters and sections and important data is adequately highlighted. All evidence and data sources are clearly referenced. An executive summary is provided summarizing the key messages, recommendations and the supporting evidence in a simple and clear way. While specific plans for dissemination of the report and communication of findings are not specified, this is also not currently standard practice for most HIAs internationally. The report is well structured and is written with a clear and easy to read style that is accessible to a diverse set of readers. This aspect is judged by the evaluation team, overall, to be adequately covered in the HIA process and report.

For community stakeholders presenting community feedback and recommendations in the HIA was a token gesture to show that they had been consulted. This is an important perspective to recognize and learn from. Having said this, for the evaluation team, it was still commendable that community perspectives and recommendations were given prominence

in highlighted boxes throughout the report. This is because, as has happened in some HIAs internationally, they could have been hidden away in an appendix or mentioned in a general way only. By highlighting them so prominently the HIA Team drew the attention of the reader to the fact that community views were different from the HIA Team's views. In that sense there was a good level of transparency in the HIA process and reporting.

4 Recommendations for future HIA practice

This chapter provides a number of recommendations for future HIA practice by MAPC. These recommendations are informed by the findings of the evaluation of the HIA process and report though each recommendation does not link to a specific aspect that required strengthening, a weakness or a gap discussed in the previous chapter. The evaluation team recognize that some of these recommendations would have been difficult to implement in the evaluated HIA because of the circumstances under which it was undertaken and the constraints that were imposed on it.

Recommendations on management, process and resources

- Ensure that any future contract, or agreement, for MAPC to conduct a HIA does not include substantial constraints to the scope of the HIA. It should allow for the scope of the HIA to be fully reflective of all, or the most important, health-related community concerns that emerge during the HIA process.
- Future HIAs should ensure that they are adequately funded and have a realistic timescale to undertake a good quality HIA. Funding and timescales should only be confirmed following agreement on the scope of the HIA by the HIA team and advisory or steering committee.
- Future HIA processes should include communicating the findings of a HIA directly to local communities, especially where there is disagreement among stakeholders on the findings.
- For contentious projects, consider the wider regional and national implications of the proposed project and alternative technology options and sites. This could be done by conducting a strategic regional level HIA first, before a local project level, one to understand the implications of the particular project and other similar projects being sited in the region. The aim of this strategic HIA would be to develop a strategic approach and set of criteria to enable the siting of contentious projects in a fair and transparent manner.
- For contentious projects, where there is community opposition or concern, consider supplementing proponent-generated data, information or studies with additional independent studies, for example air, water or soil monitoring, sampling or modelling, where these are deemed appropriate or requested for by local communities.
- For contentious projects, consider having an external HIA consultant conduct the HIA, to allow MAPC to act as the coordinating agency and allow for more objectivity and

challenge to the HIA, the process and the findings both from MAPC, local communities and from other stakeholders.

Recommendations on community input and involvement

- In future HIAs, community views should be given equal weight to other sources of data that informs the HIA assessment process, including the rating of impacts.
- Future HIAs should also allow for advisory or steering committee feedback, or community feedback, as appropriate, on the full draft report before it is published. Feedback received should be incorporated into the final report or justification provided why the community feedback was not incorporated. The latter issue should be discussed with communities before the publication of the final report.
- Future HIAs should make a concerted effort to engage more disadvantaged, vulnerable/sensitive and/or 'harder-to-reach' communities such as environmental justice neighborhoods.
- Future HIAs should seek to engage the proponent as a stakeholder on a HIA advisory or steering committee. This is likely to enhance ownership and implementation of the HIA recommendations on mitigation and enhancement measures.
- Future HIAs should obtain feedback from stakeholders on the effectiveness of the methods of engagement and what more could be done. Also provide a commentary, in the HIA report, on any gaps or challenges in the engagement of key stakeholders.

Recommendations on scope

- Ensure the scope of future HIAs is comprehensive and adequately assesses the key health impact pathways emerging from a proposed project. Ensure the scope of future HIAs is not artificially constrained by external factors. Should this not be possible given specific constraints or contextual factors, consider the appropriateness of terming an assessment a 'Health Impact Assessment' (i.e. avoid the use of this term) versus an assessment of specific project-related factors on public health. For example, an assessment of air quality-related impacts on public health which has used a HIA methodology, methods and tools.

Recommendations on community health baseline

- In future HIAs, expand the description and discussion of existing baseline inequalities, in health status and the state of key determinants of health, and identify health equity issues, when inequalities could reasonably be judged to be systematic, unfair and

amenable to prevention. Where inequalities and equity cannot be discussed or only to a limited extent, then an explanation should be given as why this was the case, e.g. lack of information.

- Ensure that key local health policies and regulations, e.g. municipal health regulations and local health and wellbeing plans, are considered in terms of whether the proposed project, and its siting, aligns with or goes against the aim, objectives and priorities of local health policies and regulations. The analysis and significance of health impacts and effects should also consider whether the potential positive health impacts help to reduce existing local public health burdens or whether the potential negative health impacts could worsen them.

Recommendations on literature review and evidence

- Future HIAs, should undertake as comprehensive and systematic a literature search as possible, using a clear review protocol, using recent research undertaken in the USA or in similar geographical and demographic contexts, including reviews and meta-analyses. The approach to the literature should be informed by feedback from the HIA advisory or steering committee and local communities.

Recommendations on methodology and assessment of health impacts

- Make health equity, i.e. the distribution of impacts and how they may disproportionately affect sensitive communities, such as environmental justice communities, a more prominent part of future HIAs. This could be, for example, when discussing the project-attributable impact and their characterization and assessment. Future HIAs should also analyze the health impacts and effects on vulnerable populations such as children, in particular those with a chronic condition like asthma, adults with underlying diseases like chronic obstructive pulmonary disease (COPD) and heart disease, and the elderly.
- For contentious projects, ensure that the HIA methodology of future HIAs is peer reviewed by technical subject matter experts and/or key stakeholders, as appropriate, and ensure their feedback is incorporated into the final methodology. For example, for specific technical areas such as the assessment of air quality-related health impacts or the appraisal of outputs from air quality monitoring and modelling, an air quality health expert could peer review the HIA methodology sections related to this topic.
- In future HIAs, consider taking a precautionary approach to analyzing the significance of the potential health impacts and effects and providing recommendations. This would mean impacts that are judged to be uncertain or impacts from exposures that have health effects below regulatory thresholds should be assigned some level of

health effect and mitigation measures should be developed for them (see also reporting recommendations).

- Future HIAs, should use a broad judgement framework for assessing the significance of health impacts, that have regulatory thresholds, in light of the existing evidence base. That is, use a non-threshold and a below threshold level of significance where appropriate and do not over-rely on a threshold-based approach to assessing impacts. If a broad judgment framework like the one described above cannot be used, then ensure that standards and thresholds for air, water and soil quality are used as significance criteria in a consistent way. The key issues related to this are:
 - Ensure that where the existing baseline for exposures, e.g. air or noise emissions, are near or above regulatory thresholds that this is considered in the overall analysis of health effects and not just the emissions from a proposed project. This can often be done as a cumulative assessment of existing projects in an area and the proposed new project.
 - Ensure that the combined impact of baseline and additional project-specific increases in air, water or soil pollution are the basis for developing mitigation and enhancement measures.
 - Include a qualitative and, where appropriate, quantitative analysis of combined pollutant burden on cancer risk, non-cancer risk and all-cause mortality using EPA risk estimates.
 - Ensure that in-combination additive and synergistic effects of key exposures and determinants are also considered and analyzed.
- Future HIAs, should explicitly discuss the degree of certainty or confidence attached to the prediction of health effects.

Recommendations on mitigation and enhancement measures

- Future HIAs should avoid addressing existing health needs unrelated to a proposed project, such as lifestyle-related health risks. While individual lifestyle-related health risks do need to be taken into account as existing sensitivities that could make project-related health impacts more intense, they should not be selectively targeted to minimize the implications of a project's potential health impacts. This is because lifestyle-related health risks are linked to a complex web of individual, neighborhood and societal factors and are not simply the result of individual choice.
- Future HIAs, should take a precautionary approach by recommending mitigation measures for potential negative health effects even where the effect may be judged to be small or the evidence is inconclusive or limited.

- Future HIAs, should focus the proposed mitigation and enhancement measures on project-attributable changes and impacts. Broader recommendations, where they are judged to be worth making, i.e. to address existing health needs, should be clearly labeled as not resulting from the assessment of project impacts.

Recommendations on monitoring and follow up

- Future HIAs should where possible, provide details on monitoring arrangements, who is responsible for monitoring and actioning mitigation and enhancement measures, and the timeframes for implementing them.

5. Conclusion

This document reports on the independent evaluation of the HIA process and report, including an evaluation of specific conditions and limitations, of the *'Health Impact Assessment of a Proposed Natural Gas Compressor Station in Weymouth, MA'* (Weymouth Compressor Station HIA). It also provides recommendations for strengthening future HIA practice by MAPC. The HIA report and process were evaluated using a review framework, and set of review criteria, based on US and international guidance on HIA.

No HIA is perfect and every HIA can be strengthened and improved. The HIA reviewed in this report was no different. This review identified a number of areas of good, or adequate, practice in the HIA and a number of areas that could have been strengthened. There are two key areas that needed strengthening that are worth highlighting: the scope of the HIA and the assessment approach taken on specific impacts, especially the assessment of air quality-related health impacts. In discussing these weaknesses, it is important to note the conditions and limitations that constrained the Weymouth Compressor Station HIA.

With regards to the scope of the HIA, specifically the scoping out of public safety- and climate change-related health impacts, various factors stemming from the Governor's Directive worked to narrow and constrain the scope of the HIA. The evaluation team recognize that the narrow scope is a direct reflection of the constraints and limitations imposed by the Governor's Directive. However, there were various points at which MAPC could have acted differently. At the beginning, MAPC could have asked to work in partnership with the agencies responsible for the review of public safety- and climate change-related impacts to develop a set of cross-referenced reports. During the latter part of the HIA process, once it was clear that no public safety or climate change reports were forthcoming, MAPC could have highlighted this critical health-relevant assessment gap with the commissioner of the HIA and asked for a widening of the scope of the HIA. Once the HIA report was drafted, MAPC could also have stated clearly in the HIA report that the assessment was based on a preliminary and limited HIA that could only be completed once the other two assessments were undertaken, and their reports published. It could also have recommended in the HIA report that a more detailed and wider HIA was needed if the other two assessments were not undertaken. One final action that MAPC could have undertaken, would have been to withdraw from the contract.

With regards to the assessment of air quality-related health impacts, the evaluation team considers that the HIA used a narrow approach to assessing these potential health effects. This approach relied solely on a comparison of project-attributable air emissions and their impact on air quality against regulatory thresholds. Sufficient weight was not given to the existing high levels of air pollution and the existing health status of communities in the project

area. The HIA evaluation team understands this approach may have been a reflection of MassDEP's long standing practice to assessing a proposed project's air emissions as part of its air quality permitting function. That is, to appraise a proposed project's emissions without taking account of existing background levels of air pollution. This practice is, however, too narrow for the purposes of a HIA.

Finally, apart from the areas that needed strengthening, in particular the two mentioned above, much of the HIA process was undertaken in line with what is generally considered good international practice.

6. Appendices

Appendix 1 - Biography of Reviewers and Peer Reviewer.

The main reviewers were Drs Salim Vohra and Filipe Silva, with Dr Janis Shandro providing internal peer review.

Salim Vohra

Dr Salim Vohra, a British national, is a medical doctor by education, with a Master's in Environmental Epidemiology & Policy and a PhD in Public Health & Policy, both from the London School of Hygiene and Tropical Medicine (UK). Salim is a founder-director of PHD. He is a Lecturer in Health Promotion and Public Health (University of West London), a Conjoint Lecturer at the Faculty of Medicine, University of New South Wales (Australia) and an Editorial Board Member at the Environmental Impact Assessment Review. Select professional highlights relevant to this assignment include:

- Technical lead in more than 50 HIAs across Europe and low- and middle-income countries for projects in a range of sectors, including in Oil and Gas.
- Peer reviewer for HIAs undertaken by other professionals for projects in the UK, Australia and elsewhere.
- Lead author of HIA guidelines (e.g. The ICMM HIA guidelines) and contributing author to the development of HIA guidelines of various international organizations, including the World Health Organization and the Asian Development bank, and national governments or institutions (including specifically for oil and gas sector projects or extractive sector projects).
- Advisor to national governments and international financial institutions on institutionalizing HIA and health in EIA, including on setting up processes and developing tools for evaluating HIA reports submitted by project proponents.

Filipe Silva

Dr Filipe Silva, a Portuguese national, is a medical doctor with a master's in Public Health, focused on environmental health and impact assessment, from the London School of Hygiene and Tropical Medicine (UK) and further training on Health Impact Assessment from the University of Liverpool (UK). Filipe's area of specialization within impact assessment is on the health impacts from exposure to ambient air pollutants. Filipe is the current co-Chair of the Health Section of the International Association for Impact Assessment. Select professional highlights relevant to this assignment include:

- Technical lead or team member in more than 30 HIAs across Europe and low- and middle-income countries for projects in a range of sectors, including in Oil and Gas.
- Peer reviewer for HIAs undertaken by other professionals for projects in the UK and Australia.
- Contributing author to the development of HIA guidelines of various international organizations, including the World Health Organization and the Asian Development bank, and national governments or institutions (including specifically for oil and gas sector projects or extractive sector projects).

- Advisor to national governments and international financial institutions on institutionalizing HIA and health in EIA, including on setting up processes and developing tools for evaluating HIA reports submitted by project proponents.

Janis Shandro

Dr. Janis Shandro, a Canadian national, has a co-specialized PhD in engineering and population health from the University of British Columbia, Canada. She has over a decade of experience in conducting HIA, reviewing HIA's and other project related documentation, and implementing successful health mitigations for projects in various sectors, including in Oil and Gas. Janis has worked in over 25 countries. Select professional highlights relevant to this assignment include:

- Technical lead for > 25 due diligence reviews benchmarked by IFC Performance Standards/Equator Principles for extractive sector projects globally (including in North America) for community health and safety components including HIAs or health in ESIA's (since 2011).
- Technical lead conducting HIA for LNG Canada project (Canada's largest infrastructure project to date, \$40 billion project) (present).
- Technical lead/advisor for developing and implementing community health and safety/emergency preparedness and response strategies globally for Anglo American (present).
- Community health and safety/influx manager for Nghi Son Petrochemical Refinery Project (Viet Nam's largest infrastructure project at time - \$9 billion investment project) involved conducting HIA and implementing relevant community health and safety/influx mitigations to IFC Performance Standards (2013-2018).

Appendix 2 - Completed Evaluation Tables

1. REVIEW PREPARATION

1 REVIEW PREPARATION	STATUS	INFORMATION
1.1 Roles and responsibilities		
1.1.1 Identification of the review coordinator.	Completed	Dr Salim Vohra
1.1.2 Identification of the review team, their roles and responsibilities.	Completed	Dr Salim Vohra, Dr Filipe Silva
1.1.3 Identification of areas that may require involvement of reviewers and/or informants with special expertise.	Completed	None
1.2 Review framework		
1.2.1 Identification of relevant legislation, codes of practice and/or guidance documents.	Completed	Air quality regulations Noise regulations
1.2.2 Identification and use of previous reviews that may have covered similar projects.	Completed	None used as not relevant for review.
1.2.3 Identification and use of previous reports available in the literature in published journals or in the grey literature.	Completed	This review was informed by a number of documents: Governor Baker's Directive, July 14 2017 Massachusetts Department of Health and Bureau of Environmental Health Request for Proposals to Undertake a HIA Metropolitan Area Planning Council HIA Proposal Three reports by the GBPSR
1.3 Review process		
1.3.1 Time frame for the health impact assessment review process.	Completed	November 2019 to February 2020
1.3.2 Stakeholders to be involved in the impact assessment review process.	Completed	Interviews with key stakeholders on their perspectives on the HIA process and report. These were undertaken in December 2019.

1 REVIEW PREPARATION	STATUS	INFORMATION
1.3.3 Foreseeable constraints of the health impact assessment review process.	Completed	Validation of information and data used and reported in HIA report was not undertaken. It is assumed that the data presented in valid and accurate.

SECTION 2. CONTEXT

2 CONTEXT	REVIEW FINDING
2.1 Site description and policy framework	
<p>The report describes the location, design, size and give an outline of the area of land take during the construction and operation phase of the project site and the surrounding area.</p> <p>2.1.1</p> <p>[Presentation or reference to diagrams, plans or maps will be beneficial for this purpose. Graphical material should be easy to understand without having any knowledge about planning and design.]</p>	<p>The project is discussed on pages 13-14. The description provided is good however it is short.</p> <ul style="list-style-type: none"> • Location of proposed project is described. • Design of the proposed project is described. • Size and land take required is described. • Description of surrounding area is provided <p>There is no cross reference to other documents, e.g. the Environmental Impact Assessment, that might provide more details about the project.</p> <p>There is no discussion of why this site was chosen and what other sites were considered.</p> <p>Lack of detail on activities likely to take place during the construction and operation phases. No discussion of length of construction phase. Some details are provided later in the analysis of health impacts chapters. See pages 123-124 and 143-145.</p>
<p>2.1.2 The report describes the way in which the project site and the surrounding area are currently used, both formally and informally, and by whom.</p>	<p>This is described on pages 13 and 36-42 (Land use and Environmental Context section) and 140-141 (Recreational and Conservation Lands).</p> <p>No discussion of who uses the existing two recreational spaces near the proposed site: Kings Cove and Lovell's Grove.</p>
<p>2.1.3 The report describes the policy context and states whether the project accords with significant policies (local, regional, national, international, or sector specific) that protect and promote wellbeing and public health and reduce health inequalities.</p>	<p>There is no discussion of how the project relates to specific national, regional or local policies.</p> <p>The context for why the HIA was undertaken is described pages 14-16.</p>
2.2 Project description	
<p>2.2.1 The report describes the aims and objectives of the project, and the final operational aspects of the project in terms of how it will work.</p>	<p>The aim and objectives of the project is discussed on pages 13-14. Some details of the final operational aspects of the project are provided on pages 143-145. More detailed information would have been helpful</p>

2 CONTEXT	REVIEW FINDING
<p>The report describes a do-nothing option and other alternative options to the project 2.2.2 have been described and assessed</p> <p>[The potential health impacts of doing nothing and the other alternative options have been described.]</p>	<p>There is no discussion or assessment of a do-nothing option or of potential alternative options to the project.</p>
<p>The report describes the key project decision points and deadlines including the 2.2.3 estimated duration of the construction phase, operational phase and, where appropriate, decommissioning phase.</p>	<p>No discussion of key project decision points, deadlines or estimate duration of different phases.</p>
<p>The report describes the project's proponent, the management/organization of the 2.2.4 project, the source of funding for the project, relationships with other proponent projects, and any external project partnerships or collaborations.</p>	<p>The project is a private sector project commissioned and funded by Algonquin Gas Transmission, LLC (a subsidiary of Enbridge, Inc.).</p>
<p>The report describes how the HIA was originated, what organization or organizations 2.2.5 commissioned the HIA, source of funding for the HIA, what person or team led and conducted the HIA and their roles, and whether there was a HIA steering or advisory group and who the members were of this group.</p> <p>[This can be described as the governance framework, terms of reference and process for the HIA.]</p>	<p>Clear description of how HIA originated and what person/organization commissioned the HIA. See pages 14-17.</p> <p>Clear description of HIA Advisory Team members and how they were recruited. See page 1 and pages 18-19.</p> <p>No description of HIA team members.</p>
<p>The report describes the spatial and commercial links to other existing and proposed 2.2.6 neighboring projects or programs and analyses the possible cumulative impacts of these projects and programs on affected populations.</p>	<p>No description of links other existing and proposed neighboring projects or analysis of the implications of these existing and proposed projects on the project.</p>
<p>2.3 Baseline health profile</p>	
<p>2.3.1 The community health profile establishes an information base from which requirements for health protection, health improvement and health services can be assessed.</p>	<p>Clear description of key baseline information: demography, existing land uses and environmental context, and health behaviors and conditions. See pages 27-46.</p>
<p>2.3.2 The community health profile sets out the dates the data were published, the geographic location the data covers, the population groups that are profiled and, wherever possible, estimates of future trends.</p>	<p>The community profile sets out dates the data were published, the authors of the data, the geographical location the data covers and the populations that are profiled.</p> <p>No discussion or estimates of future population trends.</p>

2 CONTEXT	REVIEW FINDING
<p>2.3.3 The community health profile provides robust and detailed data on sensitive/vulnerable population groups.</p>	<p>This is often difficult to do. There was no disaggregation of baseline information by sensitive/vulnerable groups. There was some demographic information, area information on environmental justice communities is provided, and general likely to be at population groups at increased risk. See pages 35-36 and 58-59.</p>
<p>2.3.4 The community health profile describes the health inequalities and equity issues within and between the population groups profiled.</p>	<p>There is some discussion of health inequalities or health equity issues between areas within the study area in terms of environmental justice areas and health behaviors. Though this is not within and between population groups or linking to existing environmental health issues.</p>
<p>2.3.5 The community health profile provides information on key health outcomes and on the wider determinants of health.</p>	<p>Information on key health outcomes and key determinants of health are provided.</p>
<p>2.3.6 The community health profile of affected communities and groups has an appropriate level of comprehensiveness and detail to support the appropriate identification, analysis and prioritization of both positive and negative health impacts and effects.</p>	<p>The community profile seems to be comprehensive. However, unclear what other routine public data sources could have been used but have not been.</p>
<p>2.3.7 The community health profile sets out the assumptions and limitations of the profile and where appropriate specific data used in the profile.</p>	<p>Limitations of the community profile are described.</p>
<p>2.4 Evidence review</p>	
<p>2.4.1 The HIA report includes and uses the evidence from literature/evidence reviews, stakeholder opinions and experiences, and technical data (where relevant) to inform the analysis and prioritization of health impacts and effects.</p> <p>[Technical data may include robust data sources on air quality, noise, transport or from other key environmental, economic or technical disciplines where relevant to the proposal and possible impacts.]</p>	<p>A clear description of key scientific evidence as well as community perspectives and key technical data is presented to inform the analysis and prioritization of health impacts and effects. Air quality, pages 63-72. Noise, pages 110-117</p> <p>The discussion of community perspectives and community recommendations is particularly commendable.</p>

2 CONTEXT	REVIEW FINDING
<p>2.4.1 The HIA report describes how stakeholder knowledge and experience (qualitative) was sought and considered. The methods of engagement were appropriate, and their effectiveness evaluated. The range of stakeholders and how many people from different groups were engaged is recorded.</p>	<p>Clear description of how stakeholder knowledge and experience was considered and sought. The methods of engagement were appropriate.</p> <p>The effectiveness of the methods of engagement is not discussed.</p> <p>No description of the range of stakeholders and how many people from different groups attended the two community meetings.</p>
<p>2.4.2 The HIA report provides a literature/evidence review search strategy that is clear, and the methodology and sources used are relevant and appropriate to the project.</p>	<p>A short description of how the literature review was undertaken is provided. Page 23</p>
<p>2.4.3 The HIA report uses evidence that is up to date (as feasible), of a high quality and from different independent and trustworthy sources. [The quality and depth of evidence should be enough to inform the assessment of likely impacts; and, where possible, there should be some critical appraisal of the literature used. Evidence on health profiles of communities may rely on routinely collected data that may not be available for every year]</p>	<p>The evidence used is up-to-date, high quality and from different independent and trustworthy sources.</p>
<p>2.4.4 The report sets out the limitations of the evidence collected and a rationale for the possible identified inconsistencies or scientific gaps are provided where appropriate.</p>	<p>No discussion of limitations of the literature review.</p> <p>Some discussion of limitations of specific research, see page 70-71 on self-reported health surveys and data.</p>
<p>2.4.5 All evidence and data sources are clearly referenced.</p>	<p>Evidence and data sources are clearly referenced</p>

SECTION 3. MANAGEMENT

3 MANAGEMENT	REVIEW FINDING
3.1 Screening, Scope and Process and Methodology of Screening and Scoping	
<p>The report describes the HIA <u>screening process</u> for the project, who was involved</p> <p>3.1.1 internally and externally to the project being screened, who led the screening process and the findings of the screening process.</p>	<p>Governor Baker requested the HIA so the screening process was Governor Baker’s decision to commission a HIA.</p>
<p>The <u>scope</u> of the HIA describes which health outcomes and determinants of health and wellbeing were/will be considered in the HIA including a justification for any</p> <p>3.1.2 health outcomes and determinants that were scoped out; across the lifecycle of the project (construction, operation and where appropriate decommissioning and remediation).</p>	<p>The report does set out the scope of the HIA in terms of outcomes and determinants.</p> <p>However a range of aspects are not fully discussed: Justification for which pathways were scoped in and which were not, particularly the community identified pathways of concern, was not provided or limited.</p>
<p>The <u>scope</u> of the HIA describes the existing sensitive/vulnerable groups, who may be disproportionately adversely affected by the project, and how they were/will be</p> <p>3.1.3 considered in the analysis of health impacts and effects; across the lifecycle of the project (construction, operation and where appropriate decommissioning and remediation).</p>	<p>The baseline identifies key sensitive/vulnerable groups however no sensitive/vulnerable groups are specifically mentioned in the scoping section.</p> <p>However, sensitive groups are discussed in various sections of the report. Evidence review section, see pages 68, 73, 95, 114-115, 116. Noise impact section, see page 110. Other mechanisms, page 150. Vulnerable groups are discussed in relation to the scope, baseline, evidence review and community perspectives on pages 10, 26, 37, 53, 58, 130, 147. Analysis of impacts pages 149-151.</p>
<p>The <u>scope</u> of the HIA describes what health inequalities and health equity issues (aside from sensitive and vulnerable groups)_are considered in the HIA; across the</p> <p>3.1.4 lifecycle of the project (construction, operation and where appropriate decommissioning and remediation).</p>	<p>This is not discussed in the scope. Inequality is not discussed. Inequities is discussed in relation certain groups (in summarizing the evidence base, though not in assessing impacts) e.g. people of color and with lower incomes who already experience inequities also experiencing a reduced feeling of ownership and control of the area where they live.</p>
<p>3.1.5 The report describes the screening and scoping stages of the HIA.</p>	<p>There was no specific methodology used during formal screening process. The HIA was commissioned by the Governor to address community concerns and requests for a HIA.</p> <p>The methodology and findings of the scoping phase are set out clearly pages 18-23.</p>

3 MANAGEMENT	REVIEW FINDING
<p>The report describes how the <u>quantitative evidence</u> was gathered and analyzed 3.1.6 (where appropriate), its relevance to the HIA, and what gaps there were in the evidence.</p>	<p>Quantitative health baseline information and air quality modelling information were used and their sources and how they were analyzed are clearly presented.</p>
<p>The report describes how the <u>qualitative evidence</u> was gathered and analyzed 3.1.7 (where appropriate), its relevance to the HIA, and what gaps there were in the evidence.</p>	<p>Qualitative evidence on the health impact of key determinants is presented and their sources and how the scientific evidence was interpreted are presented.</p>
<p>The <u>assessment methodology</u>, methods and tools, set out in the scope or elsewhere, consider the physical, mental, social, spiritual health and wellbeing alongside the wider social, cultural, economic and environmental determinants of health, sets out an appropriate framework for assessing the the significance of health impacts/effects e.g. magnitude, intensity, spatial extent, numbers of people affected. 3.1.8</p>	<p>The scope was limited as one particular determinant, Public safety, was being considered by another agency. However, no systematic list of determinants was used at the screening or scoping stage before being narrowed down through community consultation and review of the scientific literature. This would have allowed for determinants such as community cohesion and social capital to be added. The determinant land use and outdoor spaces would have been better considered as two separate determinants, for example housing and land use, leisure and recreation. A threshold based approach to assessing impacts/effects is taken rather than a no threshold approach for both air emissions and noise.</p>
<p>The <u>assessment methodology</u>, set out in the scope or elsewhere, takes a 3.1.9 precautionary approach i.e. where the evidence is not conclusive, absence of evidence is not seen as evidence of absence of health impacts.</p>	<p>The assessment methodology does not take a precautionary approach to analyzing the significance of the potential health effects.</p>
<p>3.2 Governance</p>	
<p>The report describes the governance process of the HIA, clearly stating if the HIA was guided and scrutinized by a steering group (and who belonged to it), which organization has final ownership or is accountable for the report and its findings and the existent relationship between all the intervening parties. 3.2.1</p>	<p>The key agencies are discussed and the members of the advisory group are listed. However, it is not clear who has final ownership of the HIA and how the HIA and its findings will inform the decision-making process is not set out.</p>
<p>The report explicitly states the geographical, temporal and populational scope of the HIA, along with information about the terms of reference for the HIA. 3.2.2</p>	<p>The HIA clearly sets out the geographical and populational scope. The temporal scope should have been more clearly stated in years, the report mostly talks about the construction and operation phases.</p>

3 MANAGEMENT	REVIEW FINDING
<p>The report clearly states any constraints and limitations faced during the 3.2.3 preparation of the HIA, including but not limited to limitations of methods, scope, availability of evidence or non-involvement of key informants and stakeholders.</p>	<p>At key points the HIA sets out the assumptions and limitations of the analysis, pages 46, 109, 130 and 148.</p>
<p>3.3 Engagement</p>	
<p>The report identifies the relevant stakeholder groups, including organizations 3.3.1 responsible for protecting and promoting health and wellbeing that should be involved in the HIA.</p>	<p>The HIA identified key stakeholders and involved them through a HIA Advisory Group</p>
<p>The report describes how local communities and sensitive/vulnerable groups and other NGO, business, and governmental stakeholders were consulted and engaged in the HIA process.</p> <p>3.3.2 The stakeholders engaged should reflect the diversity of all those who are likely to be affected by the project, that work with or provide goods and services to these affected communities, involved in the development of the project, involved in the implementation of the project and health protecting and promoting organizations.</p>	<p>The report includes a clear explanation of how local communities and key community organisations were consulted in the HIA process and the findings of the community consultation are set out in the HIA report.</p>
<p>The report documents the feedback received from stakeholders and an analysis of the comments to identify priority issues, expectations (positive) and concerns (negative) that stakeholders had.</p> <p>3.3.3 OPTIONAL ADDITIONAL ASPECT (that cannot always be undertaken as balance between engagement and fear of giving personal details): Where this data is collected or available, is stakeholder feedback disaggregated and analysed by stakeholder type, gender, age, ethnicity, disability, income and any other key criteria as relevant.</p>	<p>Most HIAs do not do consultations that have detailed demographic information on participants. They mainly aim for qualitative diversity. Key concerns and recommendations are set out.</p> <p>OPTIONAL ASPECT: These are not disaggregated or analyzed by different community and demographic groups. However, given the nature of the consultation it would not be expected that detailed demographic information would be collected from participants. The HIA report could have set out why.</p>
<p>The report describes and properly explains the reasons for not engaging with 3.3.5 specific stakeholders e.g. members of the public, community groups or community or local organizations.</p>	<p>Consultation with key stakeholders and community groups was undertaken. No explicit discussion of whether any groups were missed out and the reasons why.</p>

SECTION 4. ASSESSMENT

4 ASSESSMENT	REVIEW FINDING
4.1 Impact and effect analysis	
4.1.1 The report details the nature of the potential health effects, including the relative degree of likelihood and severity of specific impacts.	The HIA does detail the nature, degree of likelihood and severity of potential health impacts.
4.1.2 The findings of the assessment are accompanied by a statement of the level of certainty or uncertainty attached to the predictions of health effects.	This is a challenging aspect to consider and is rarely explicitly considered. It is implicitly considered in the ratings of the likelihood.
4.1.3 The report identifies and explains the use of any standards and thresholds used to assess the significance of health impacts.	Key environmental health standards are identified and explained. However, the relationship and value of each standard in relation to the others is not as clear as it could be.
4.1.4 The report identifies and adequately consider and assess any health concerns shared by the community that are related to the project.	The HIA report identifies and sets out the community's concerns and recommendations. The report does not assess some of the health concerns of the community.
4.2 Analysis of distribution of impacts/effects	
4.2.1 The report describes the possible cumulative impacts of related projects or programs in the vicinity.	The HIA report does identify and consider the emissions from existing projects and programs however it does not assess the cumulative impacts.
4.2.2 The report makes clear which populations or communities will be impacted and by which potential impacts.	
4.2.3 The report clearly identifies any inequalities or health equity issues in the distribution of predicted health impacts, detailing the effects that these inequalities and/equity issues might entail.	Equity issues are not addressed.

4 ASSESSMENT	REVIEW FINDING
4.2.4 Effects on health were examined based on the population profile, clearly determining whether effects are more prevalent in certain demographic or vulnerable groups.	Existing burden of disease attributable to risk factors that the project could change (e.g. air pollution) seems to not have been taken into account in characterizing health impacts.
4.3 Description of health effects	
<p>The report describes the potential health effects of the project, both beneficial and adverse.</p> <p>4.3.1 [These should be identified and presented in a systematic way. Does the identification of impacts consider short-term, long-term (and are these timescales defined where possible?), direct and indirect impacts on health and well-being? Does the identification of health impacts distinguish between the construction phase, the operational phase and where relevant the decommissioning phase?]</p>	Both positive and negative health effects are identified and analyzed.
<p>The report identifies the potential health impacts in relation to the wider determinants of health and the five key health outcomes: communicable diseases, non-communicable diseases, mental health and wellbeing, injury and nutritional disorders.</p> <p>4.3.2</p>	The health impacts and effects are discussed in relation to the wider determinants of health and the five key health outcomes.
<p>The report describes the causal pathway leading to health impacts and effects in textual or diagrammatic form.</p> <p>4.3.3</p>	Key health impact pathways are presented in textual and diagrammatic forms.
<p>The report presents a balanced report of impacts and effects i.e. no under-reporting of negative impacts or overstating of positive impacts.</p> <p>4.3.4</p>	The scope of the HIA was narrowed in that only the additional effects of the compressor were considered, so that some impacts could be judged to be under-reported e.g. air quality and noise.
<p>The report describes both individual and in-combination health impacts and effects.</p> <p>4.3.5 [For example, the individual impacts of noise and air pollution as well as the in-combination effects of both noise and air pollution on the same community or group.]</p>	<p>The HIA does consider individual impacts but does not consider in-combination impacts of existing and new air emissions and noise and the in-combination effects of noise.</p> <p>Limited analysis of the implications of in-combination (impacts from the project interacting with each other) and cumulative impacts (impacts from the project interacting with impacts from other existing or proposed neighboring projects)</p>

4 ASSESSMENT	REVIEW FINDING
4.3.6 The report describes changes in health inequalities and/or health equity related to the project and their effects.	The report fails to describe changes in health equity.

SECTION 5. REPORTING

5 REPORTING	REVIEW FINDING
5.1 Discussion of results	
<p>The report describes how the engagement undertaken has influenced the HIA in terms of findings and recommendations on design, construction, operation and/or decommissioning.</p>	<p>The issues and recommendations emerging from stakeholder engagement is presented however it is not clear how these have informed the findings and recommendations or approach of the HIA. Its seems like they have had little influence.</p>
<p>5.1.2 The report clearly stated the effect on the health and wellbeing of the population of the project and of any alternatives which have been considered.</p>	<p>The report does clearly state the health and wellbeing effect of the project, however it does not consider or assess any alternatives.</p>
<p>5.1.3 The report justifies any conclusions reached, particularly where some evidence has been afforded greater weight than others.</p>	<p>The HIA report does justify key conclusions however it does not explicitly set out what weighting was given to the evidence presented.</p>
<p>5.1.4 The engagement undertaken by proponents has clearly influenced the development of mitigation and enhancement measures. [Either by ratifying the proposed measures or by determining changes in the development of the measures to accommodate meaningful feedback.]</p>	<p>The stakeholder recommendations from the advisory committee are presented however they are separate from the main recommendations of the HIA, pages 152-156.</p>
<p>5.1.5 The report clearly states the level of commitment of the project proponent to the implementation of mitigation and enhancements measures. An explanation of how the findings will be used to inform the design, construction, operation, decommissioning and overall decision-making processes within the project (and throughout the lifecycle of the project). The specific steps or actions that will be taken by the proponent or are already in place.</p>	<p>No discussion on the level of commitment of the project proponent to the implementation of mitigation and enhancement measures.</p>
5.2 Recommendations	
<p>5.2.1 The report describes a list of recommendations to facilitate the minimization of adverse health effects. [Recommendations should be specific, measurable, appropriate, realistic and time bound; should cover the construction, operational and, where appropriate, decommissioning phases; be clearly linked to the impacts identified; be clear on who is expected to act.]</p>	<p>A list of recommendations are set out however some are not directly related to the project and some key mitigation measures are presented only in the community recommendations.</p>

5 REPORTING	REVIEW FINDING
<p>Mitigation measures for negative health effects are considered even where the evidence is inconclusive or absent.</p> <p>5.2.2</p> <p>[Inconclusive or absence of evidence is not seen as absence of health impacts or consequences.]</p>	<p>It is not clear whether this has been done. The discussion implies that this was not the case.</p>
<p>The report provides a plan for monitoring key health and wellbeing impacts and effects using relevant indicators, suggesting a process for evaluation.</p> <p>5.2.3</p> <p>[A detailed plan for how project-related health impacts and, where possible, actual health effects on affected populations are monitored over the life of the project.]</p>	<p>Air quality monitoring is recommended however no specific details and recommendations of where and what should be monitored is presented.</p>
<p>The project proposes mitigating measures for the negative health effects and minimizing approaches for residual health risks whenever feasible.</p> <p>5.2.4</p> <p>[Prevent, mitigate or minimize potential negative impacts or unintended consequences.]</p>	<p>Given the findings were no impact, cannot say either way.</p>
<p>The report comprises enhancement measures that facilitate the occurrence of beneficial health effects.</p> <p>5.2.5</p> <p>[It maximizes the benefits and opportunities of positive impacts.]</p>	<p>Some health promotion around key lifestyle factors are recommended however these are not appropriate and directly relevant to the project assessed. Examples of directly relevant enhancement measures would have been: reviewing overall pollution levels and looking to reduce them across all industries in the HIA study area; enhancing the local parks adjacent to the project site; the proponent providing community funds that a community steering group could use to enhance the environmental justice areas.</p>
<p>5.3 Reporting and communication of findings</p>	
<p>The intended audiences for the report is clear and the language, information and tone of the report is suitable for those range of audiences. Information, evidence and analysis is logically arranged in sections or chapters and important data is signaled in a table of contents or index.</p> <p>5.3.1</p> <p>[Does the report flow and read well? Can key sections and data be easily found?]</p>	<p>The report is very well structured and is written with a clear and easy to read style that is accessible to a diverse set of readers. Particularly commendable is the highlighting of community perspectives and recommendations in highlighted boxes.</p>

5 REPORTING	REVIEW FINDING
<p>An executive summary or non-technical summary is provided summarizing the key messages, recommendations and the supporting evidence in a simple and clear way.</p> <p>5.3.2 [The summary should cover all main issues discussed in the report and contain at least a brief description of the project and the potentially affected population, a description of the most important positive and negative health effects and project's impact on quality, an account of the main recommendations and mitigation measures to be undertaken by the developer and main outline of the action plan recommended to manage and monitor the health effects and evaluate the HIA.]</p>	<p>A non-technical summary is provided that is written in the same style as the main HIA report.</p>
<p>5.3.3 The plans for dissemination of the report and communication of findings are specified.</p>	<p>This is not standard practice for most HIAs. No discussion how the report will be disseminated and the findings communicated.</p>

Appendix 3 - Interview questions

The key questions that were discussed in the semi-structured interviews are presented below.

1. What was your role in the HIA process/HIA?
2. What did you think about the scope of the HIA? Was it appropriate in your judgment/opinion?
3. What did you think of the stakeholder/community engagement - the advisory committee and the community meetings?
4. What did you think of the methodology of the HIA? In terms of how it assessed health impacts?
5. What did you think of the findings of the HIA?
6. What did you think about the final HIA report as an overall document?
7. What could have been done differently?
8. What more would you have liked done?
9. How did the regulatory/decision-making process enable/constrain the HIA in your judgment?

Appendix 4 – Further details on the review of key health impact pathways (air quality and noise environment)

Review of health effects from changes to ambient air quality

A key health impact pathway identified and assessed in the HIA was “Air Quality-related Health Impacts”. This pathway was conceptualized as having the potential to affect health outcomes both directly and indirectly. This section focuses on the identification, characterization and assessment of direct (physical) health effects as described in the HIA report, specifically on the aspects that could be strengthened in future HIAs.

In the HIA report the method of assessment used to characterize and assess potential health effects associated with project-attributable changes to ambient air quality during the operation phase is described as

...a qualitative assessment was conducted of how the contribution of emissions from the proposed station would change exposure levels in the surrounding areas. Exposure levels for air toxics were compared to MassDEP’s Allowable Ambient Limits (AALs) and Threshold Effects Exposure Limits (TELS), which are ambient air health guidelines, and for criteria pollutants were compared to EPA’s National Ambient Air Quality Standards (NAAQS).

This method of assessment used was narrow and one that is more often used in Environmental Impact Assessments and permitting assessments. As applied and described in the report, this method of assessment appears to disregard wider considerations (e.g. the scientific evidence, existing levels of exposure to, the existing health profile of project-affected populations and the precautionary principle) that are important considerations for the assessment of this potential health effect. Furthermore, the statements on the assessment of the direct health effects from changes to air quality, as reported, can be debated. Such statements include (underline is our own):

Estimated air emissions from the proposed station are not likely to cause health effects through direct exposure because estimated air emissions do not exceed daily or annual health-protective regulatory standards or guidelines. (p63)

Exposure to air pollution at certain levels can have immediate and long-term effects on people’s health. Thresholds that have been established as health protective are used in regulatory processes in order to assess how new projects may impact health. When considering anticipated changes in air emission exposures due to criteria pollutants and air toxics associated with the proposed compressor station, the new emissions introduce

the possibility of increased exposure to air pollutants and potential health impacts if such exposures exceed health standards or guidelines. (p108)

The operation of the station is estimated to emit criteria pollutants that will result in concentrations below NAAQS and air toxics that will not contribute concentrations above TELs and AALs. The highest concentrations of pollutants are modeled to occur within and very close to the station fence line and so the highest direct exposures would be at the project site. Based on available information for direct exposure, there are neither positive nor negative health effects expected as estimated emission levels are less than health protective standards and guidelines. (p109)

While the approach to impact assessment, as described in Part 2 of the report (p22), is broad and in line with good HIA practice, the specific method of assessment that was ultimately used to characterize and assess air quality-related health impacts was very narrow.

The judgement framework used to assess these impacts seemed to rely solely on a comparison to regulatory standards i.e. comparing the predicted/modelled contributions of the compressor station to air pollution levels against MassDEP's TEL and AAL. This is a regulatory compliance approach used in air quality permitting. This approach could have been expanded with more considerations being factored into the judgement framework and/or the reporting of the characterizations of potential health effects and the reasoning behind such assessment could have been based on a wider set of considerations (such as those listed on Part 2 of the HIA report) explicitly laid out when rating health impacts in the HIA report. Specific considerations of interest could have included the existing burden of air pollution-related health conditions in the affected population, the existing level of air pollution (exposure), a description of the evidence base (including uncertainties), as well as community concerns, stakeholder opinions, relevant aspects of the policy, legal and regulatory framework and air quality modeling projections, eventually alongside an epidemiological health risk assessment.

HIAs in general tend to assess impacts mostly based on a qualitative professional judgement (even though this judgement is often informed by outputs of underlying or complementary quantitative methods such as air quality modelling). However, this qualitative professional judgement is often not sufficiently reported or reported in a narrow manner (rather than based on a broad public health approach). It has recently been proposed internationally that assigning significance to a health impact in the context of HIA should not be a formulaic approach (based on a computation of magnitude vs. sensitivity or similar variables) but rather on a narrative description of all considerations that have informed the judgement on significance. This approach may be especially suited for health impact pathways, such as this one, where various considerations seem to be competing against each other when rating significance.

Furthermore, the technical validity of some statements is open to discussion. These statements are often seen in EIA reporting, and sometimes in HIA reporting. However, these statements are often not fully understood by different audiences and/or may not be entirely accurate:

Thresholds that have been established as health protective are used in regulatory processes in order to assess how new projects may impact health. (p108)

This is commonly reported in both EIAs and HIAs. While valid, this statement can be misleading and inappropriately used as justification for absence of effects. A more accurate description would be that thresholds have been established following an administrative process (standards setting) that is science and health based (for example in the US based on EPA's Integrated Science Assessments) and reflect a level that is considered to be 'safe enough' i.e. an acceptable level of risk. However, it is clear and widely accepted that for various pollutants there is no concentration level that below which health effects cease to occur at the population level. For other pollutants, health effects are known to occur at concentration levels below regulatory thresholds. Therefore, while compliance with regulatory thresholds is commonly used in EIA and sometimes in HIA as a good enough proxy for assessing health impacts, one should not state that such compliance is equivalent to the absence of health effects as this may not be true for all situations. In the case of this HIA, it was further stated that:

potential health impacts [can occur only] if such exposures exceed health standards or guidelines [and] that operation of the station is estimated to (...) result in concentrations below NAAQS and air toxics that will not contribute concentrations above TELs and AALs [therefore] there are neither positive nor negative health effects expected as estimated emission levels are less than health protective standards and guidelines.

As described, it can be argued that this reasoning is not entirely accurate. For example, for PM2.5 there is no concentration level (threshold) below which health effects cease to occur. Any increase in PM2.5 concentrations would lead to a health effect at the population level. This means that the discussion and characterization should then be around the likely magnitude of the effect (if a qualitative judgement is being undertaken). The same argument can be made around hazardous air pollutants and volatile organic compounds that have no threshold effects. Any emission of these pollutants to air would entail some health risk. This magnitude tends to be, in most cases (i.e. in the context of infrastructure projects in high income countries using best available technologies and pollution control technologies), on the level of *negligible* to *small* or within acceptable levels of risk. *Negligible* can be understood or conceptualized as resulting in a magnitude of effect that is indistinguishable from normal variations in the outcomes of interest such as daily variations in rates of hospital admissions

or non-accidental mortality. Acceptable levels of risk can be drawn, for example, from carcinogenic effects.

The concluding statements in the HIA report could therefore be debated, as some community stakeholders have. Based on our experience of previous projects it is possible (if not likely) that the (physical) health effects from project-attributable changes in air quality can be considered negligible or small at the population level (for the project-affected population). This would follow from the results of an air quality dispersion modeling indicating the level of contribution that the project would give to various pollutants of interest. In the case of this HIA, some of these pollutants at these locations of interest are described, e.g. the project-attributable concentrations of for benzene, formaldehyde, and acrolein at the King's Cove walking path and at the nearest residence on Bridge Street (which are reported to be very low), while others are not (for PM_{2.5} it is just stated that NAAQS will not be exceeded but the actual project contribution at sensitive receptor locations is not reported). Interestingly, the project-attributable contribution to daily (1-hour maximum) concentrations of NO₂ is 17.4 ug/m³ at the east fence line of the proposed compressor station. It is unclear how close this is to sensitive residential receptors or how such project-attributable concentration would be expected to be at these locations. In any case, 17.4 ug/m³ is a quite high contribution to air pollution levels. Exposure to NO₂ is associated with various health outcomes, including short-term effects such as non-accidental mortality and respiratory hospital admissions. Currently, there is lack of evidence of a threshold for NO₂ (although the evidence base for assessing the existence of a threshold or the shape of the concentration– response curve is weaker than for PM_{2.5}). Furthermore, the World Health Organization (WHO) considers that the health effects of short-term exposure to NO₂ can be quantified/estimated for any level of exposure with confidence (i.e. reliable estimation can be derived based on concentration-response functions). From a HIA point of view an additional exposure of 17.4 ug/m³ for NO₂ 1-hour max would indicate an additional risk that warrants further analysis. However, a further analysis may not find an impact of public health relevance, as usually reported in HIA reports, as for that we would need to estimate how many people are exposed and their existing health status and health burdens. This is where using the precautionary principle would have meant that the impact even if not analyzed quantitatively would be set out as a potential adverse effect and mitigation and enhancement measures recommended to minimize any potential effects from even a small increase.

With regards to hazardous air pollutants and volatile organic compounds, while the HIA did not explicitly characterize their potential health effects using quantitative methods, the following paragraphs were extracted from the project's environmental assessment⁹ (p2-98):

⁹ Atlantic Bridge Project Environmental Assessment. May 2016.

Small quantities of a number of HAPs can form from combustion of natural gas and blowdown events. Combustion of transmission quality natural gas can result in acute (1-hour) and chronic (long-term) exposures. (...) We evaluated the acute and chronic health risks of exposure from HAPs and VOCs from combustion of transmission quality natural gas and blowdown events from transmission compressor stations in the New Market Project EA under docket CP14-497. (...) Our assessment included conservative assumptions (e.g. individuals exposed to maximum concentrations from full-capacity facility operations for 24 hours per day, 350 days per year, at the fence line of the facility) and uncertainty factors to overestimate risks. The results of this analysis showed that the cancer and non-cancer health risks of short-term and long-term exposures to all constituents of natural gas during combustion, venting, or a full station blowdown event would be below established benchmarks (i.e., are safe) to protect the general population and sensitive subgroups (those with health conditions, children, elderly, etc.). The proposed compression at the Weymouth Compressor Station (...) are smaller and would emit lower quantities of pollutants than any of the three compressor stations analyzed in the New Market Project health risk assessment. Therefore, we find that the health risks from operation of the Project facilities would not be significant.

Review of health effects from changes to the noise environment

A key health impact pathway identified and assessed in the HIA was “Noise-related Health Impacts”. This pathway was conceptualized as having the potential to affect health outcomes both directly and indirectly. The HIA report concluded that noise-related health impacts during operation are neutral, unlikely and of very low magnitude. However, there seem to be inconsistencies in the reporting of the reasoning behind these conclusions, specifically around the indicators used and subsequent comparisons made to regulatory thresholds (i.e. by the EPA) and/or guidelines values (i.e. by the WHO). These include:

- Reference to EPA’s Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (EPA, 1974), in that an outdoor level of 55 decibels and indoor level of 45 decibels as thresholds that prevent annoyance and interference with daily activities. These thresholds are expressed in the EPA document as different indicators – $L_{eq(24)}$ and L_{dn} . $L_{eq(24)}$ represents the sound energy averaged over a 24 hour period while L_{dn} is a compound indicator that represents the L_{eq} with a 10 dB nighttime weighting. These indicators are defined for different areas with L_{dn} being suggested for quieter areas.
- Reference to the WHO Environmental Noise Guidelines for the European Region (WHO, 2018), which provide guideline values as L_{den} and L_n . L_n is the average sound pressure level over the night period and L_{den} is a compound indicator for day-evening-night noise level based on energy equivalent noise level (L_{eq}) over a whole day with a

penalty of 10 dB(A) for night time noise (23.00-7.00) and an additional penalty of 5 dB(A) for evening noise (19.00-23.00).

- The HIA report presents the current noise levels through the use of different indicators, which make it difficult to follow throughout the text, and through the use of indicators that are different to those used as thresholds, recommended by the EPA, and guideline values, recommended by the WHO. For example:
 - Figure 66 reports “data according to a one-hour equivalent sound level” following measurements “during various periods of the day with the intent to document the worst-case noise hour”. It is stated that “Two of the sites (...) identified sound levels (58 dB(A) and 67 dB(A), respectively) that exceeded the EPA recommended outdoor sound level (55dB(A)).” But this seems to be comparing one-hour equivalent sound levels with EPA’s 55dB(A) that could be for either $L_{eq(24)}$ or L_{dn} .
 - Table 68 does report on measurements taken during a 24-hour period, specifically average daytime, evening and nighttime noise levels. However, It fails to report such data as L_{den} or L_n and the subsequent text again seems to compare one-hour equivalent sound levels (not reported in the table 68) with EPA’s 55dB(A) that could be for either $L_{eq(24)}$ or L_{dn} .
 - Figure 73 reports L_{90} levels, which establish the lowest sound levels (i.e., the sound level that is lower than 90% of the measured sound level) for daytime and nighttime periods. This again fails to report sound levels as L_{den} or L_{dn} or make any comparison to EPA or WHO thresholds/guidelines values.
- The HIA report presents the future estimated noise environment with the project in operation again using different indicators to those used as thresholds by EPA and guideline values by the WHO. For example:
 - Figure 76 reports daytime (7am to 10pm) noise levels and Figure 77 reports nighttime (10pm to 7am) noise levels. The subsequent text compares daytime noise levels with a 55dB(A) threshold that could be EPA’s threshold for either $L_{eq(24)}$ or L_{dn} (and not “daytime”).

On p130 it is stated that “While ambient daytime and sound levels would increase due to the proposed station [...] the increased outdoor sound levels from normal operations are not estimated to be at a level or exist for extended periods of time that would cause annoyance (i.e., not exceed 55 dB(A)).” However, as explained above, it seems that the HIA authors are not comparing the same indicators.

Furthermore, the described link between environmental noise during operations and annoyance can be debated. The HIA report states that “the increased outdoor sound levels from normal operations are not estimated to be at a level or exist for extended periods of time that would cause annoyance (i.e., not exceed 55 dB(A)).” (p130).

This statement is an oversimplification and does not reflect well the evidence. The evidence on environmental noise annoyance, for example as explained in Guski et al (2017)¹⁰ shows that environmental noise annoyance occurs at lower levels of exposure. High levels of annoyance, the public health outcome of interest in this impact pathway, is usually defined those respondents using the upper 28% or the upper 40% of the annoyance response scale. In setting these types of environmental health standards, health agencies usually define a threshold that reflects what is perceived (at the time of the standard setting) as sufficiently protective for public health. In the case of the recent setting of the WHO guideline values, the threshold of 53 dB for annoyance (linked to road traffic noise) reflects an absolute risk of high annoyance of 10% of the exposed population which was considered in the WHO guidelines as the relevant level of risk not be exceeded, i.e. sufficiently protective of public health. The guidelines also stated with confidence, however, that there was an increased risk for annoyance below this noise exposure level (e.g. 9% of the population would report being highly annoyed with an exposure level of 40 dB L_{den}), but probably there would be no increased risk for other health outcomes. An alternative statement that could have been used in the HIA report was that the increased outdoor sound levels from normal operations are not estimated to be at a level that would be expected to be associated with considerable levels annoyance, followed by an explanation of what is considered 'considerable' and how this is rooted in established public health evidence and practice.

The same point can be made on the nighttime noise levels. The WHO night noise guidelines (WHO, 2009), concluded that while there was insufficient evidence that physiological effects at noise levels below 40 dB L_{night} are harmful to health, there were observed adverse health effects at levels starting from 40 dB L_{night} . At 40 dB, about 3–4% (depending on the noise source) of the population still reported being highly sleep-disturbed due to noise, which was considered relevant to health. In setting the new night noise guidelines values, the GDG agreed that the absolute risk associated with the guideline value selected should not exceed 3% of the population reported being Highly Sleep Disturbed to be considered sufficiently protective of public health.

A further aspect noted from the review of the PSR report was that night-time noise values in some locations were already above guideline values and that the project would contribute to further exacerbate this exposure. While this seems to be the case, we would argue that in the context of HIA, this effect would be felt for a small population and based on a small exposure which would, at the population level, likely result in a small health effect contributing a small amount to the additional risk of noise-related health outcomes. Nonetheless, given the breach of regulatory thresholds, this aspect should have led to the development of mitigation measures for those residents affected. For example, through the use of landscaping to create

¹⁰ Rainer Guski, et al. "WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Annoyance." *International Journal of Environmental Research and Public Health*, vol. 14, no. 12, MDPI AG, 2017, doi:10.3390/ijerph14121539.

embankments and the installation of additional noise screening at the fence line or window glazing at the affected properties to ensure the noise levels would remain below threshold.

PHD

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