Chapter 1

Ambient Air Quality

Ambient air pollution is the major environmental health risk factor in Israel.[1] Ambient air quality in Israel is affected by various sources of pollution, some natural (such as desert dust) and others anthropogenic (such as emissions from industry, transportation, and biomass combustion). Exposure to ambient air pollutants is associated with adverse health effects such as respiratory diseases, cardiovascular morbidity, Type 2 diabetes, cancer, and adverse developmental outcomes including small for gestational age (SGA) and low birth weight. Ambient air pollutants include particulate matter (PM) of different diameters, ozone (O_3), nitrogen oxides (NOx), sulfur oxides (SOx), lead, carbon monoxide (CO) and volatile organic compounds (VOCs).

Ambient air quality is monitored by the Air Quality Division at the Ministry of Environmental Protection (MoEP) through a network of over 150 air quality monitoring stations, including widely deployed fixed and mobile units that continually monitor criteria pollutants (such as PM and ozone). MoEP also conducts biweekly sampling at nineteen permanent sampling sites for non-criteria pollutants such as VOCs, metals, and dioxins.

Ambient air quality in Israel is regulated under the Clean Air Law of 2008, which went into effect in January 2011. The statute set air quality values for numerous pollutants; MoEP updates them periodically in collaboration with the Ministry of Health (MoH) and other stakeholders, most recently in 2016. The two main values are: (a) **target values**—exceedance of which may harm human health or the quality of human life, property, or the environment, including soil, water, flora, and fauna; an effort should be made to meet these target values although they are not mandated by law; and (b) **environmental values**—exceedance of which constitutes severe or unreasonable air pollution. Although the environmental values are based on the target values, they are more lenient because they take into account the best available technologies and the feasibility of preventing exceedance of the target values. Notably, for many ambient air pollutants there is evidence of adverse health effects even at levels below the target values. Table 1 shows the environmental standards of selected pollutants listed in the Clean Air Law and compares them with EU and U.S. standards and World Health Organization (WHO) guidelines.[2]

Ambient Air Quality Standards for Selected Criteria Pollutants in Israel Compared with Standards in the EU and U.S. and with WHO Guideline Values

→ **Table 1**
Negev, 2020[2]

	Time Interval	**Israel** (μg/m³)	**EU** (μg/m³)	**U.S.** (μg/m³)	**WHO Guideline Values** (μg/m³)
PM_{10}	24 h	130	50	150	50
	Annual	50	40	—	20
$PM_{2.5}$	24 h	37.5	—	35	25
	Annual	25	25	12	10
Ozone	8 h	140	120	138	100
Nitrogen Dioxide (NO_2)	1 h	200	200	188	200
	Annual	40	40	98	40
Sulfur Dioxide (SO_2)	10 min	—	—	—	500
	1 h	350	350	197	—
	24 h	50	125	—	20
	Annual	20	—	—	—

Progress since 2017

The *Environmental Health in Israel 2017* report defined challenges related to Ambient Air Quality. Progress achieved in this area during the past three years is outlined below.

The challenge: Develop a strategy for regular sampling of contaminants that cannot be monitored continuously

In short: Monitoring and biweekly sampling of dozens of air pollutants began in 2015. The nineteenth monitoring site was added in 2018.

Challenge for the coming years: Continue monitoring and extend it to additional sites.

Under the Clean Air Law, twenty-eight criteria ambient air pollutants (including O_3, SO_2, $PM_{2.5}$, PM_{10}, NO_x, NO_2, CO, benzene) and non-criteria pollutants (including VOCs, poly-aromatic-hydrocarbons [PAHs], aldehydes, metals, ammonia, and hydrogen sulfide) are monitored. Contaminants that reach concentrations of approximately one-tenth of their target or environmental values are sampled throughout the year on a biweekly basis. Monitoring began in 2015 at fourteen sites. In 2016, four additional monitoring sites were added; the nineteenth monitoring site was added in 2018. In total, some twenty air pollutants have been sampled in Israel since 2015 on a biweekly basis, including formaldehyde, PAHs, heavy metals, and ammonia.

Legend: Significant progress | Some progress | Little or no progress

The challenge: Full implementation of the National Plan for the Prevention and Mitigation of Air Pollution

In short: Most of the National Plan has been implemented.	**Challenge for the coming years**: Complete the implementation of the National Plan and develop a follow-up plan for further mitigation of air pollution in Israel.

In 2013, the National Plan for the Prevention and Mitigation of Air Pollution in Israel (Government Resolution 707) was approved and goals were set for 2015 and for 2020.[3] The plan has been almost fully implemented. According to a report on the implementation of the plan, presented to the Government, the sections for which MoEP was responsible were implemented and other parts have yet to be applied:

- The 2008 plan to scrap old vehicles was renewed in 2018 for old diesel-powered vehicles only. According to MoEP estimates, diesel-powered vehicles are responsible for ~80% of traffic-related air pollution.
- The Ministry of Finance, in consultation with the Minister of Environmental Protection and the Minister of Transport, has not presented the Government with proposed tools and measures for reducing travel in leased vehicles.
- The Minister of Finance, in consultation with the Minister of Environmental Protection, has not set differential tax rates for different types of fuel.

MoEP is developing a follow-up plan for reducing air pollution in Israel.

The challenge: Reduce ambient concentrations of PM_{10} and ozone in metropolitan areas where concentrations exceed environmental values

In short: PM concentrations and ozone precursors have decreased somewhat but ozone concentrations have not.	**Challenge for the coming years**: Continue reducing emissions of PM ($PM_{2.5}$ and PM_{10}) and of ozone precursors.

Based on data reported to the MoEP managed Pollution Emissions Inventory, PM_{10} emissions decreased by 57% between 2012 and 2018 following a downturn in the use of coal for energy production along with other regulatory requirements. The main sources of PM_{10} emissions in Israel are industry (20%), transportation (33%), and waste incineration (20%).[4]

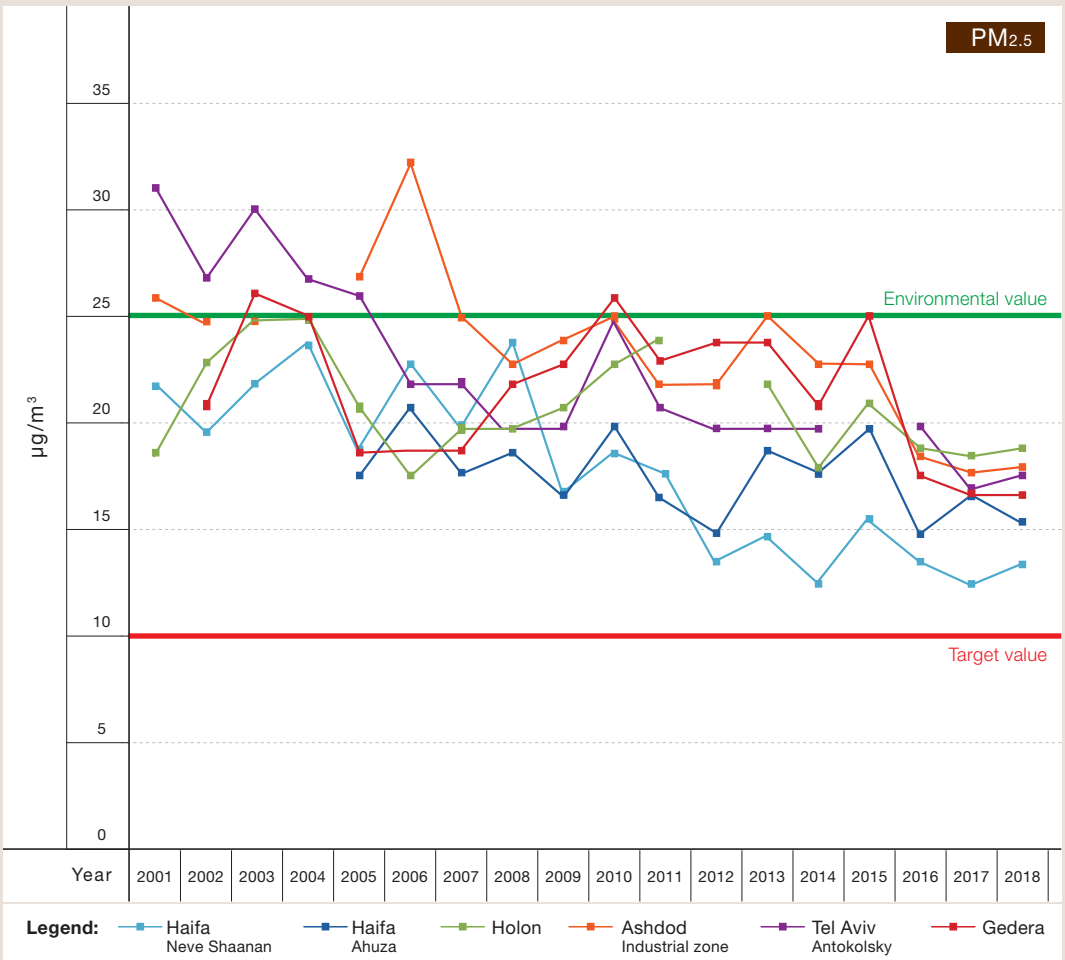
Data from air monitoring stations in Israel indicate that annual average concentrations of PM_{10} and $PM_{2.5}$ in different parts of the country exceed the target values (20 and 10 $\mu g/m^3$, respectively) but not the environmental values (50 and 25 $\mu g/m^3$, respectively). Although the number of exceedances in $PM_{2.5}$ concentrations at various monitoring stations, including those close to roads, has been decreasing, $PM_{2.5}$ concentrations remain relatively high, ranking Israel thirty-seventh among forty OECD countries.[5] Ozone precursors including NOx have also been decreasing. Unlike other air pollutants that have seen declining concentrations over the years (such as SO_2 and NO_2),

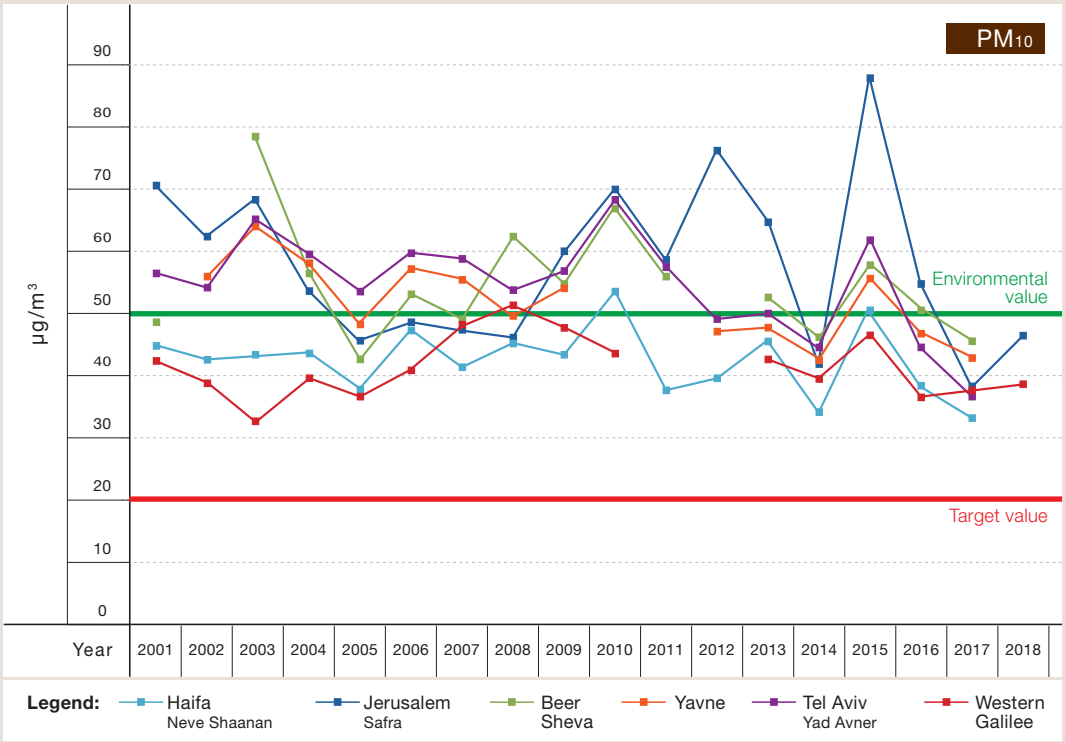
concentrations of PM_{10} and ozone show no downward trend (Figure 1).[6] Moreover, according to an assessment published in 2020 and based on 2016 exposure data, the entire population of Israel is exposed to PM_{10} concentrations that exceed the target value while falling short of the environmental value.[7]

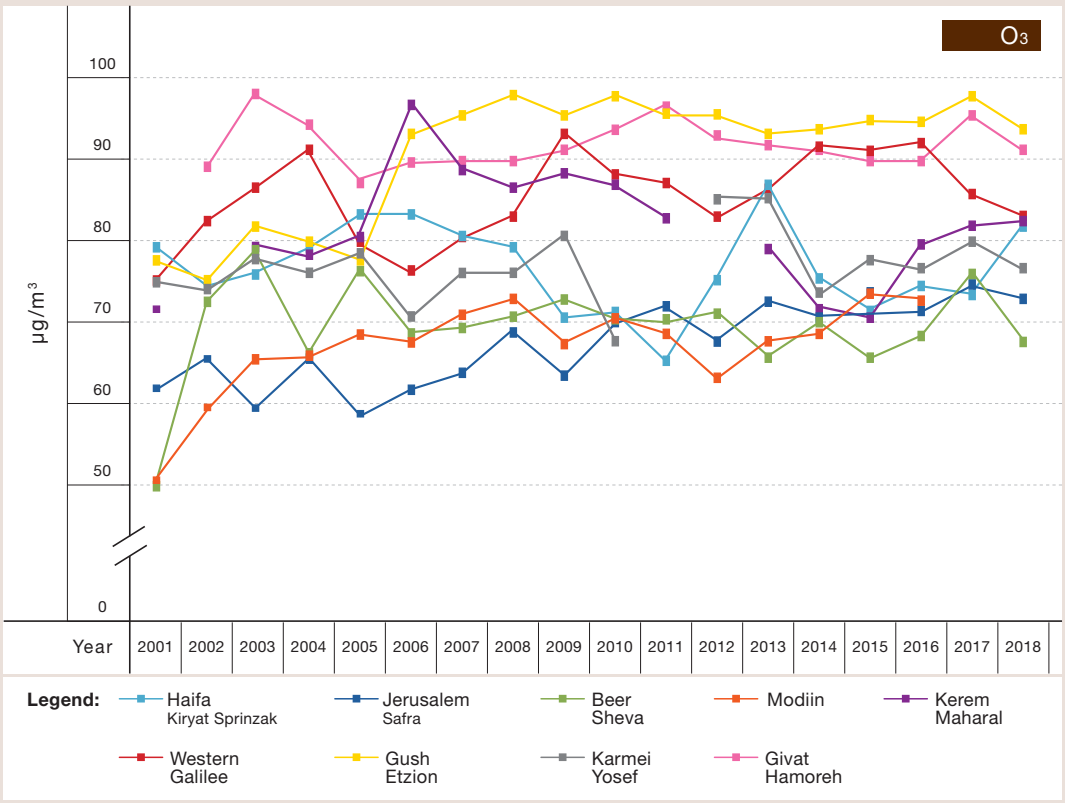
According to the Global Burden of Disease database the mortality rate from PM exposure in Israel has remained constant in recent years and was 26.4 per 100,000 people in 2017.[1] Based on OECD data, this rate stood at 28.41.[8] The distribution of mortality attributed to PM exposure in 2017 was 35% from cardiovascular diseases, 22% from diabetes, 18% from non-malignant respiratory diseases, 12% from lung cancer, and 13% from other causes. Notably, a PM exposure mortality assessment tailored to Israel is needed because the composition of PM in Israel is different from that in Europe and the U.S. (i.e., high dust levels) and may be less toxic. The death rate from chronic obstructive pulmonary disease (COPD) attributed to ozone exposure in Israel has also remained constant in recent years (3.0 per 100,000 people in 2017).

Trends in Air Pollutant Concentrations (Annual Averages) at Selected Sights in Israel, 2001–2018

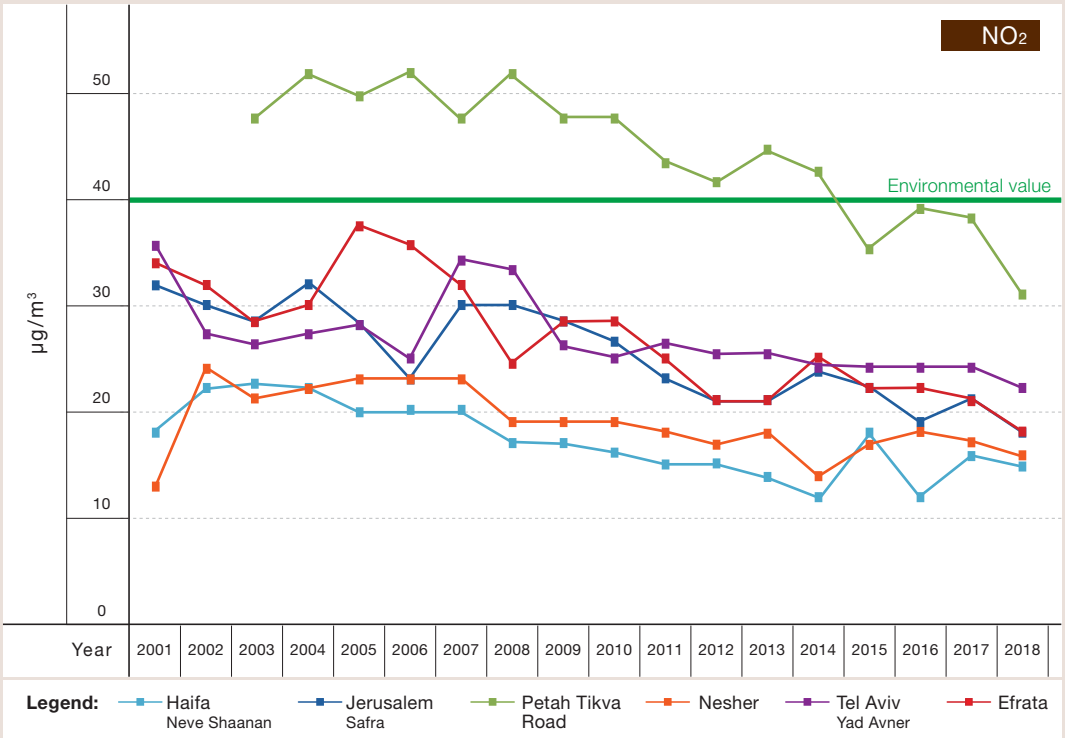
→
Figure 1
Israel Ministry of Environmental Protection[6]

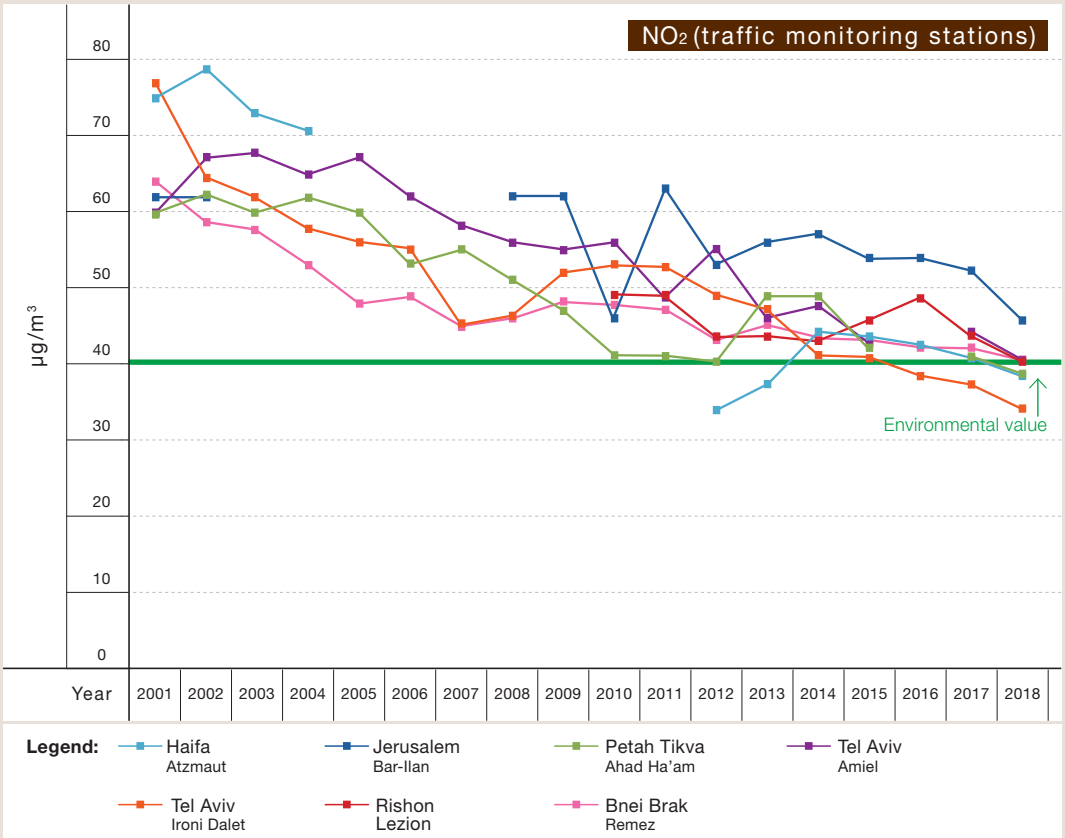


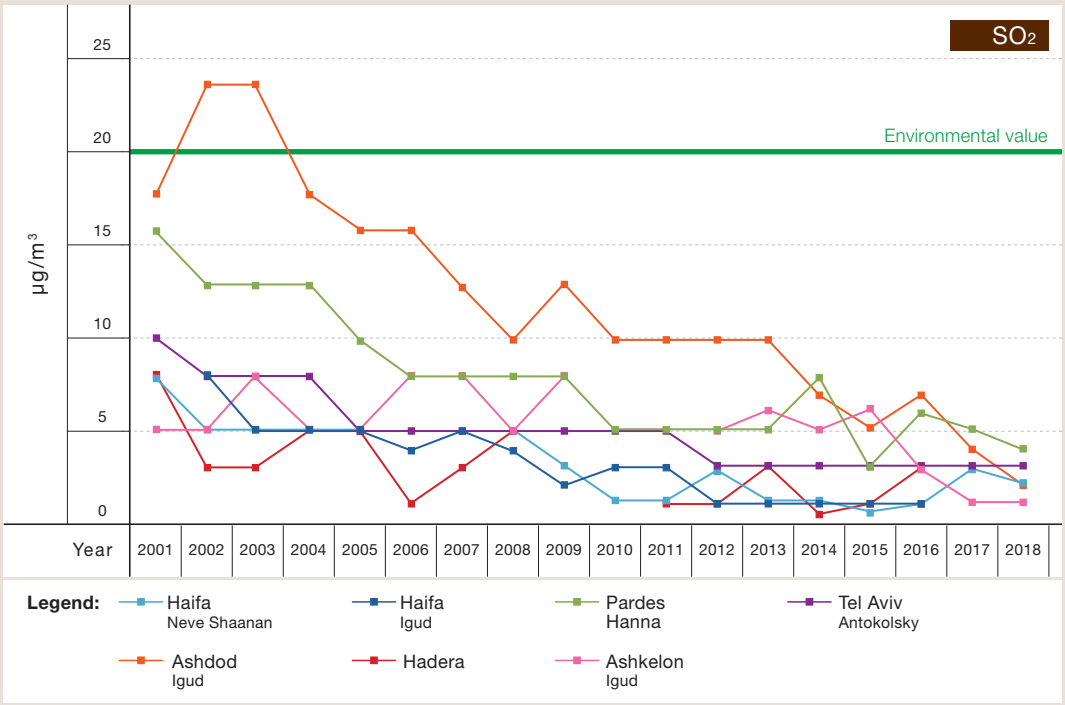




* No annual target and environmental values were defined for ozone.

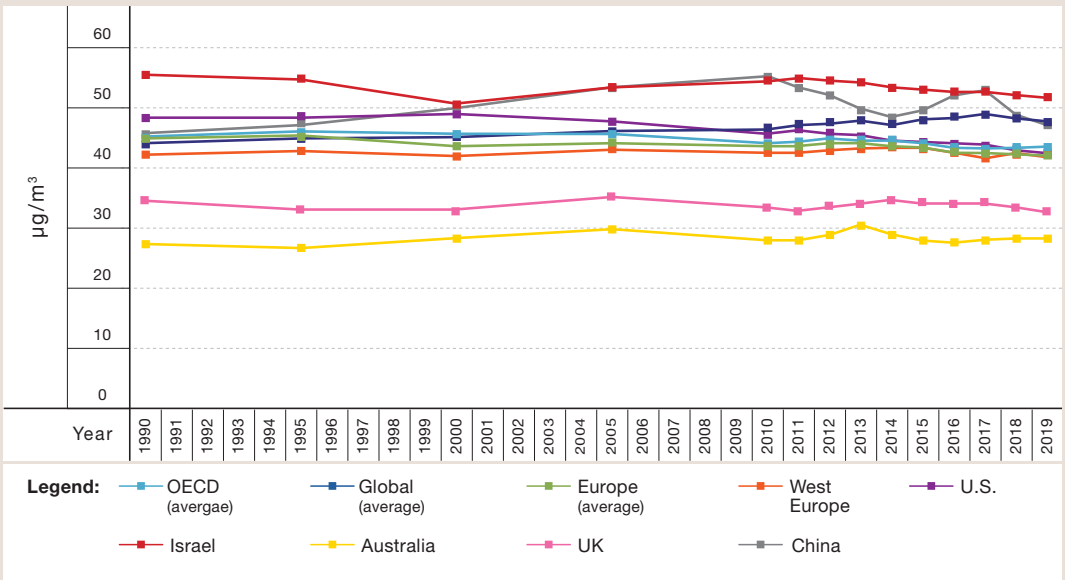

NO2
µg/m3
50
40
30
20
10
0
Environmental value
Year
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Legend:
Haifa
Neve Shaanan
Jerusalem
Safra
Petah Tikva
Road
Nesher
Tel Aviv
Yad Avner
Efrata


NO2 (traffic monitoring stations)
µg/m3
80
70
60
50
40
30
20
10
0
Environmental value
Year
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Legend:
Haifa
Atzmaut
Jerusalem
Bar-Ilan
Petah Tikva
Ahad Ha'am
Tel Aviv
Amiel
Tel Aviv
Ironi Dalet
Rishon
Lezion
Bnei Brak
Remez



In rural areas that have high concentrations of ozone, no decrease in concentrations was recorded. Moreover, the population-weighted mean exposure to ozone in Israel is significantly higher than the global average, the OECD average, and the European average (Figure 2).[1] Therefore, it is essential to reduce emissions of ozone generating sources (hydrocarbons and NOx), including by promoting the use of renewable energy, encouraging green transportation, and implementing the updated National Plan for the Prevention and Mitigation of Air Pollution in Israel.[9]

Average Population-Weighted Ozone Exposure in Various Countries



← **Figure 2**
Global Health Data Exchange 2020[1]

The challenge: Update target and environmental values for a range of air pollutants

In short: The target and environmental values of some air pollutants are being updated.	**Challenge for the coming years**: Continue to update the target and environmental values periodically (in a five-year cycle).

The target and environmental values of twenty-eight contaminants were last determined in 2011 and are supposed to be updated every five years. MoEP is expected to submit the next update by the beginning of March 2022. As part of this process, MoEP prioritized the chemicals that have target values in need of updating and reviewed new information published by regulatory organizations such as the WHO, the European Environment Agency (EEA) and the U.S. Environmental Protection Agency (U.S. EPA). The process also includes discussions on updating the target values of seven air pollutants: toluene, styrene, nickel, NOx, suspended particulate matter (SPM), sulfate, and settling dust. MoEP is conducting an assessment of the environmental values of nine air pollutants (toluene, styrene, nickel, SO_2, 1,2-dichloroethane, tetrachloroethylene, hydrogen sulfide, vanadium and arsenic). The assessment is expected to be completed in 2021. When the process of updating target and environmental values is completed, MoEP will present the Internal Affairs and Environment Committee of the Knesset with a proposal for its approval.

The challenge: Improve the spatial distribution of air monitoring stations

In short: In recent years, several monitoring stations began operating in northern and southern Israel; models were employed that indicate the distribution of air pollutants in places far from established monitoring stations.	**Challenge for the coming years**: Establish additional air monitoring stations throughout the country, especially in southern Israel.

MoEP continues to establish new air quality monitoring stations and upgrade existing stations in order to monitor additional pollutants on the basis of two main criteria: areas with large or dense populations and proximity to emission sources. In recent years, monitoring stations were established in Ketura, Ashdod Port, Zikhron Yaakov, Atlit, Caesarea, and Tel Hai. (For a map of air monitoring stations in Israel, visit the MoEP website.)[10] MoEP also set up air pollution monitoring stations east of the Leviathan natural gas rig for continual measurement of benzene. Another monitoring station is planned in the near future at Haifa Port. It is important to improve the spatial distribution of the air monitoring stations and to add stations in less populated places such as the Negev in order to include the populations of these areas in epidemiological studies and assist geo-climatic research that can validate and enhance the national models used in public health studies in Israel.

Notably, annual assessments of air pollutant concentrations and daily forecasts are based not only on information from these monitoring stations but also on computerized models of pollutant dispersion (CHIMERE), with which air pollutant levels in areas far from monitoring stations can be assessed.

The challenge: Improve planning of sustainable transport

In short: Several initiatives that support the transition to sustainable transport have been promoted in recent years.	**Challenge for the coming years**: Expand the initiatives to additional cities, primarily in low-emission areas, and examine the impact of a low-emission zones on air pollution and public health.

MoEP, in collaboration with the Ministry of Transport, is leading several initiatives to improve and advance sustainable transport. Examples follow:

- support for low-emission zones - Several cities (Haifa and Jerusalem, for example) have imposed restrictions on diesel vehicles that fail to meet the Euro 4 air pollution standard or have not been fitted with a dedicated particulate filter for reducing air pollution. In Jerusalem, MoEP invested NIS 24 million to assist the municipality with this project, subsidizing the installation of filters for car owners and helping the Egged bus company to buy ten electric buses for use in the city[11];
- promoting the use of electric buses - MoEP is offering public transport companies NIS 23 million in support for purchasing new electric buses (some eighty in all) for countrywide use[12];
- promoting on-demand shuttle services such as Bubble;
- promoting transition to electric or hybrid taxis - This project, in collaboration with the Jewish National Fund (KKL-JNF), provides a subvention of up to NIS 20,000 for taxis that switch to hybrid propulsion[13];
- opening carpool lanes to reduce road congestion and traffic-related air pollution;
- supporting the transition of heavy vehicles to natural gas propulsion;
- implementing a NIS 260 million program for reducing emissions from old diesel trucks (by installing particulate filters and by scrapping)[14];
- promoting the installation of particulate filters in trains;
- promoting installation of particulate filters in garbage trucks with NIS 10 million investment (in collaboration with KKL–JNF).[15, 16]

The challenge: Integrate epidemiological data from studies conducted in Israel into assessments of the burden of disease from air pollution and associated costs

In short: MoEP is funding several studies on the burden of disease in Israel from exposure to air pollution, focusing on the Haifa Bay area.	**Challenge for the coming years**: Publish the findings as part of a burden of disease assessment on air pollution and the associated costs; expand the studies to other geographic regions.

In recent years, MoEP has funded eight epidemiological studies related to exposure to air pollution in Israel. Most studies under way focus on the population in the Haifa Bay area and compare it with populations elsewhere in the country. The studies span a range of research fields: biomonitoring, pregnancy outcomes, infant respiratory morbidity, incidence of cancer and heart disease, and economic assessments of the costs of exposure to ambient air pollutants.

In addition, MoH has been examining asthma hospitalization rates in children and adults in Israel, by region, for more than twenty years (1996–2018). In collaboration with Clalit Health Services (which insures about 60% of Israel's population), MoH is also assessing the incidence and prevalence of asthma in children (aged 2–18) and adults (25–54) by regions and districts in 1998–2015.

Since 2012, MoEP has been publishing assessments of the external costs of air pollution and greenhouse gas emissions in Israel, including the estimated cost of damage due to increased morbidity (Disability-Adjusted Life Years—DALYs) and mortality and to environmental impacts. At the present writing, MoEP is updating these assessments on the basis of the latest research and, in particular, the most recent WHO publications on the impact of air pollution on human health.[17, 18] The update includes an assessment of external costs based on recently defined values in EU countries; presentation of a range of values for air pollution from industry and transport; forecasts of the impact of climate change (in order to reflect the uncertainty that attends to such assessments); weighting by per capita GDP and population density; adjusting costs to the Consumer Price Index; distinguishing between smokestacks higher than 100 meters and shorter ones; and applying a conservative approach to assessing the external cost of greenhouse gases based on the cost of damage.

The challenge: Collect data on the contribution of different sources to air pollution in Israel, using source apportionment techniques

In short: MoEP significantly expanded the list of emission sources.	**Challenge for the coming years**: Collect information on the contribution of additional sources to air pollution in Israel; simulate chemical transport models.

The list of emission sources that MoEP collects and publishes has been expanded to include many additional sources: trains, ships, waste incineration, animal husbandry, burning of biomass in agriculture, and use of fireplaces.

MoEP is also studying strategies for reducing air pollution from shipping vessels at Haifa and Ashdod ports. A feasibility study commissioned by MoEP indicated that vessels at these ports are responsible for significant emissions of air pollutants that can affect air quality in populated areas near the ports. Moreover, vessels at Israel's seaports accounted for about 16% of total SOx emissions, 8% of NOx emissions, and about 7% of $PM_{2.5}$ emissions in 2018. In response, MoEP drafted recommendations on technological and regulatory measures that may mitigate emissions from these sources.[19]

Research on Ambient Air Quality in Israel

Exposure to Ambient Air Pollutants

- Researchers from the Technion Center of Excellence in Exposure Science and Environmental Health (TCEEH) have developed a modeling framework for estimating exposure to air pollutants among a representative sample of working Israeli adults (N ~ 168,000) for whom both residential and workplace addresses were available. They found exposure misclassification that varies throughout the day, largely on account of intra-individual movement (between work, home, and other places). They also showed that short stays in areas with high concentrations of ambient air pollutants have a relatively small impact on overall exposure to pollutants.[20]
- Researchers from MoEP and MoH, employing a hybrid model to assess the exposure of Israel's population to various air pollutants, found that the entire population is exposed to concentrations of $PM_{2.5}$ and PM_{10} that exceed target values though not environmental values and that over 1.5 million residents are exposed to concentrations of NOx that exceed target values.[7]
- Researchers from Ben-Gurion University of the Negev and Soroka University Medical Center, studying the pattern of association between exposure to anthropogenic and non-anthropogenic PM and adverse health outcomes, found a linear correlation between exposure to PM_{10} and asthmatic exacerbations in asthma patients not related to a PM source.[21]
- Several MoEP funded studies on exposure to ambient air pollutants in the Haifa Bay area are underway: (a) biological monitoring of air pollutants in blood donors living in the Haifa Bay area[22]; (b) associations between air pollutants and heart disease—heart failure and acute coronary syndrome; and (c) an economic assessment of the health impacts of exposure to air pollutants in the Haifa Bay area.
- Researchers from TCEEH have launched a source apportionment study focusing on fine PM, in particular its varying spatiotemporal patterns and the atmospheric processes that govern these changes. The study aims to characterize and develop models of the chemical composition and of the distribution of the sources of PM emission in the Haifa Bay area. Its results may shed further light on the sources of fine particulate pollution and enhance the quality of the data used for exposure and risk assessment and for mitigation strategies.

Pregnancy and Childbirth

- Researchers from Ben-Gurion University of the Negev, in collaboration with colleagues from the Hebrew University of Jerusalem and Mount Sinai Hospital in New York, studied whether the exposure of pregnant women to ambient air pollutants and to extreme temperatures is associated with low birth weight and premature birth among the population of southern Israel. In the study, encompassing over 56,000 live births, it was found that exposure to below average temperatures during pregnancy may increase the risk of adverse birth outcomes such as low birth weight and premature birth, while exposure to above average temperatures may decrease the risk of premature birth.[23]

- Researchers from Maccabi Health Services and Tel Aviv University examined the head circumference of newborns in the Haifa Bay area using Maccabi Health Services' database and did not find a higher prevalence of microcephaly (small head circumference in newborns) in Haifa Bay area in comparison with other areas in Israel.[24]
- University of Haifa researchers evaluated a model for spatial identification of environmental health hazards potentially associated with observed reduced birth weight and reduced head circumference patterns. The researchers identified a site in Haifa's industrial zone as a significant source of risk.[25]
- Researchers from the Hebrew University of Jerusalem, TCEEH, Ben-Gurion University of the Negev, and MoH, in collaboration with colleagues from Columbia University and Harvard University, studied whether the exposure of pregnant women to traffic-related air pollutants is associated with miscarriages. The research population included pregnant women from Boston and from Tel Aviv District. In both populations, an association between exposure to high concentrations of traffic-related air pollution and miscarriage, particularly between the tenth and twentieth weeks of pregnancy, was found.[26]
- A Ben-Gurion University of the Negev researcher reviewed the contribution of green infrastructure (urban vegetation such as trees, hedges, and bushes, green walls, and green roofs) to mitigating the risk of adverse birth outcomes—with an emphasis on premature birth—as a result of exposure to high ambient temperatures and air pollutants. Exposure to PM and extreme temperatures during pregnancy (especially during the first and third trimesters) was found to be associated with increased rates of premature birth whereas green infrastructure lowers PM and prevents the formation of urban heat islands. Thus, green infrastructure mitigates the adverse effects of exposure to PM and high temperatures on birth outcomes.[27]
- Researchers from the Hebrew University of Jerusalem, Ben-Gurion University of the Negev, the University of Haifa, Tel Aviv University, Rambam Health Care Campus and Maccabi Health Services are analyzing "big data" of pregnancies and births in the Haifa Bay area, with data from 1998–2017 (~750,000 births). The project examines environmental effects (including exposure to ambient and indoor air pollution) on fetal development in Haifa Bay area in comparison with other areas in Israel.[28]
- Researchers from the Hebrew University of Jerusalem, TCEEH, and the Harvard School of Public Health studied the link between traffic-related air pollution and autism spectrum disorder (ASD). The researchers examined whether mothers' exposure to NO_2 during pregnancy and newborns' post-natal exposure to this pollutant were associated with a risk of ASD in children born in 2005–2009. It was found that exposure of newborns and toddlers to NO_2, but not that of pregnant women, was associated with increased risk of developing ASD.[29]

- In a follow-up study, researchers from the Hebrew University of Jerusalem, Columbia University, and Harvard University suggested two explanations for their findings on the inverse relationship between exposure to ambient air pollutants during pregnancy and ASD (relevant to live births). The first explanation attributes other ASD risk factors in addition to mother's exposure to air pollutants; the second explanation relates to miscarriages of fetuses susceptible to ASD as a result of exposure to air pollutants.[30]
- Three MoEP funded studies are under way on the following topics: (a) biological monitoring of organic pollutants and heavy metals in mothers and their children, and examination of the effects of exposure to ambient air pollutants during pregnancy on pregnancy outcomes; (b) examining the association between respiratory illness in infants and exposure to ambient air pollutants during pregnancy and infancy; (c) examining the association between environmental exposure to ambient air pollutants and fetal growth.

Biochemical and Physiological Outcomes

- Researchers from Tel Aviv University, the Ministry of Agriculture and Rural Development, Ben-Gurion University of the Negev, and Sheba Medical Center at Tel Hashomer developed a method for exposing primary epithelial cells to PM under laboratory conditions in a way that simulates nasal respiration. They found that this exposure triggers a physiological response expressed in heightened excretion of cellular molecules such as IL-8.[31]
- Researchers from the Weizmann Institute of Science and Peking University studied the biochemical mechanism in which the Nrf2 transcription factor operates. Nrf2 can protect lung cells from the toxic effects of $PM_{2.5}$ exposure. Lung cells silenced for Nrf2 become hypersensitive to PM and exposure to PAHs increases mortality in silenced cells. The researchers showed that silencing the factor induced accelerated mitochondrial activity and that exposure to various pollutants led to lower mitochondrial membrane potential and a lower mitochondrial DNA copy number. They concluded that Nrf2 serves as a mediator for mitochondrial activity following $PM_{2.5}$ exposure.[32]
- Researchers from Tel Aviv University, Bar-Ilan University, and the University of Haifa studied the impact of exposure to noise, different temperatures, and CO concentrations on the heart rates of Jewish and Muslim women in different environments (a green space such as a park, a city center, and a residential area). They demonstrated the positive effect of visiting green spaces, where CO levels are negligible, on the women's heart rates.[33]

Respiratory Morbidity

- University of Haifa researchers reported on the prevalence of asthma among young men in urban areas in Israel (Tel Aviv, Haifa, Hadera) that have multiple sources of air pollution (industrial, traffic-related). They found that exposure to both industrial- and traffic-related air pollution have a negative effect on asthma risk in young males.[34]

- University of Haifa researchers developed a model for reducing morbidity caused by exposure to ambient air pollutants. The model involves removing the sources of emission from densely populated areas and replacing them with a green environment. Applying the model to the Haifa Bay area, they showed that relocating sources of emission would reduce the asthma morbidity rate among children in the area by about 70%.[35]
- Researchers from the University of Haifa and the Israel Defense Forces (IDF) studied associations between exposure to various air pollutants (NO_2 and SO_2) and asthma morbidity. Examining data from over 137,000 candidates for military service (seventeen-year-old males) in 1999–2008 and using several models to assess the extent of exposure to these pollutants based on their place of residence, they found a strong direct correlation between exposure to NO_2 and asthma morbidity in this population and a weaker direct correlation between exposure to SO_2 and asthma morbidity.[36]

Cancer and Cardiovascular Diseases

- Researchers from Tel Aviv University, TCEEH, the Hebrew University of Jerusalem, and Hadassah, Beilinson and Hasharon medical centers studied the link between chronic exposure to traffic-related air pollutants and new cases of cancer in a population of 10,000 people suffering from coronary artery disease. They showed that a 10-ppb increase in mean exposure to NOx (indicating a traffic-related source) was associated with a higher risk of all types of cancer, particularly of the breast, lung, kidney, prostate, and bladder.[37] In another study, the researchers found an association between a 10-ppb increase in mean exposure to NOx and increased risk of all-cause mortality among coronary-heart-disease patients (hazard ratio = 1.13).[38]
- In a follow-up study, the same group of researchers used various models to examine the association between exposure to traffic-related air pollutants (NOx) and cancer. They found a statistically significant association between exposure to these pollutants and the incidence of cancers that had previously been linked to exposure to traffic-related pollutants (lung, breast and prostate cancer) but did not find an association between this exposure and other types of cancer.[39]
- An MoEP funded study, under way, is investigating the association between exposure of seventeen-year-olds to environmental air pollutants in the Haifa Bay area and cancer incidence in adulthood.

Future Challenges

Recent years have seen progress in monitoring and studying ambient air pollutants and in reducing the emissions of some. However, improving air quality in Israel continues to pose significant challenges, primarily related to changes in the country's energy economy. In late 2019, natural gas began to flow from the Leviathan rig, located about ten kilometers west of Haifa, opposite the

Zikhron Yaakov shore. Preparing for the flow of gas, MoEP set up monitoring stations to measure benzene, toluene, and ethylbenzene. According to MoEP, the rig will have an inconsequential effect on ambient air pollution, contributing only 1% of the benzene environmental value.[40] Nevertheless, it is important to continue to monitor emissions from the rig along with other air pollutants along Israel's coastline. The flow of natural gas to Israel offers additional opportunities in the field of energy, including the construction of gas-fired power stations (trigeneration plants) in new residential neighborhoods.[41] Although trigeneration plants may reduce air pollutants in Israel overall, it is important to monitor pollutants emitted from these plants due to their proximity to population centers.

Most solid waste in Israel (76%) is sent to landfills. Incineration of waste in landfills is a major source of emissions of suspected or known carcinogens (about 60% of air emissions in 2018),[4] and the expansion of this practice will likely lead to an increase in air emissions of carcinogens and population exposure to these contaminants. Given Israel's dwindling land reserves, MoEP has been working during the past decade to reduce use of landfills and to encourage environmental alternatives for waste treatment. One such alternative is controlled waste incineration, in which energy is produced. This would entail the construction of three waste incineration facilities in close proximity to the populated areas that generate the waste, in order to reduce the cost and environmental harm involved in transporting waste.[42] Despite the energy potential of the plan, a health impact assessment is required before it can be implemented.

In addition to industrial, transport, and natural air pollution, livestock farms emit air pollutants including PM, ammonia, NOx, and VOCs. Concerns about air pollutants emitted by livestock farms have been raised by the EEA and U.S. EPA. Israel needs to monitor air quality near livestock farms and conduct studies on the impact of this potential source of emissions.

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