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Review Article

Meta-Analysis of Municipal Solid Waste Management Practice on Greenhouse Gas Emissions Frontier

Abdulshekur Ahmed*

Department of Environmental Biotechnology, Bio and Emerging Technology Institute, Addis Ababa, Ethiopia

ABSTRACT

For instance, climate change is the most important, dangerous, and complex global environmental issue to date. It is also thought to be the culprit responsible for some of the recent environmental problems the world is facing today. The most prominent of these are severe flooding in parts of Asia and America, droughts in parts of Africa, and the global food crises which gave rise to civil unrest in many parts of the world. Noticeably rising levels of greenhouse gases in the Earth's atmosphere are causing changes in our climate, and some of these changes can be traced to solid waste. The manufacture, distribution, and use of products as well as management of the resulting waste-all result in greenhouse gas emissions. Waste prevention and recycling are real ways to help mitigate climate change. This review article briefly covers works done to solve the problems of the Impacts of Municipal Solid Waste Management on Greenhouse Gas Emissions capacity and possible solutions to this problem.

Keywords: Climate change; Greenhouse gas emissions; Waste management; Global warming

INTRODUCTION

The earth has experienced many natural heating and cooling cycles, such as droughts, floods, and extreme weather events. Scientists have confirmed that the Earth's atmosphere and oceans are gradually warming due to human activity [1]. This warming will exacerbate climate change and ultimately adversely affect global food and water security. At the heart of global warming and climate change is the "greenhouse effect." Carbon Dioxide (CO_2), Nitrogen Oxides (NOX), Sulfur Dioxide (SO_2), dioxins, particulate matter, and other greenhouse gases released into the earth's atmosphere through everyday energy-use activities and environmental management practices are: Continuing to contribute to negative impacts on the global environment. Accumulation of Greenhouse Gases (GHG) that are emitted directly into the atmosphere [2].

According to this, climate change is the most important, most dangerous, and arguably the most complex global environmental problem to date [3]. Climate change not only poses direct threats to life and the environment, but is also a serious setback for sustainable development. Climate change is believed to be responsible for some of the recent environmental problems around the world. Most notable among them are the massive floods in parts of Asia and the Americas, droughts in parts of Africa, and the global food crisis that has caused social unrest in many parts of the world. Even if the current global economic recession is caused by ill-informed economic practices, careful scrutiny could reveal climate change as a contributing factor.

LITERATURE REVIEW

Greenhouse gases are emitted at almost every stage of waste management. Therefore, developing appropriate treatment methods from source to landfill is essential to reduce the environmental impact [4]. Total baseline greenhouse gas emissions from household solid waste are estimated at 153.41 tons of CO_2 equivalent per day, with compostable and recyclables accounting for 80.02% and 11.73% respectively [5].

According to the, contribution of CH_4 emissions from landfills and landfills to greenhouse gases is only 1.7% of the total emissions of the Pacific islands' region [6]. Climate change will affect all waste management activities such as collection, segregation, treatment, transport and disposal to varying degrees of complexity [7].

This review article briefly covers works done to solve the problems of the impacts of municipal solid waste management on greenhouse gas emissions capacity and possible solutions to this problem.

Correspondence to: Abdulshekur Ahmed, Department of Environmental Biotechnology, Bio and Emerging Technology Institute, Addis Ababa, Ethiopia, E-mail: abdikoomaraf@gmail.com

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Different municipal solid waste management and its Greenhouse Gases (GHG) emission capacity

GHG emissions from waste transportation: Estimates of emissions from transportation operations were obtained by calculating emissions from local waste collection and subsequent transportation. Together, these represent the emissions generated by all waste transportation operations.

A study was found at total transport emissions of 14,234 tones CO_2e for both source separation and partial mixed waste management and 13,323 tones CO_2e for source separation. The annual mileage during salvage work was 543,942.2 km. An important point, however, is that the collection part of waste transport accounts for the majority of emissions [8].

GHG emissions from intermediate facilities: Intermediate facility operations include sorting, grouping of like materials at collection stations, and transshipment of solid waste from collection vehicles onto larger vehicles to additional destinations. According to a study by, this corresponds to 506 tons of CO_2e emitted for source separation [9]. Similarly, the partially mixed waste is collected in two compartments of the vehicle, which reduces the need for waste separation stations rather than using multiple small containers as in waste separation at the source. Easy to operate. You will need more energy.

GHG emissions from treatments: Various treatment options under consideration include landfill, incineration, and organic treatment (AD and IVC combined). Studies show that 1966 tons of CO_2e were emitted from landfill waste. Waste incineration (without energy recovery) emitted 2,409 tons of CO_2 [10].

GHG emissions caused by open burning: Open farm burning, forest fires, and waste burning are all sources of soot into the atmosphere. About 40% of the world's black carbon emissions come from the burning of fields and forests [11]. However, emissions estimates are uncertain and regional differences are significant. Depending on waste composition and oxidizing factors, open burning accounts for only 58% of CO_2 emissions. CH_4 is more of a problem in open burning because most of the carbon in the waste is not oxidized [12].

Emissions caused by incineration: Municipal waste incineration produces climate-related emissions. These are primarily CO_2 (Carbon Dioxide) and N_2O (Laughing Gas), NOx (Nitrogen Oxides), NH_3 (Ammonia), and organic C emissions measured as total carbon [13]. Combustion of 1 mg of municipal waste in a municipal waste incinerator release about 0.7 mg to 1.2 mg of Carbon Dioxide (CO_2 emissions). The biogenic carbon content is typically in the range of 33%-50%. [14].

Emissions due to combustion were calculated taking into account the electricity produced and the associated reduction in emissions. For power plants using coal, the EF for electricity from coal is 0.32232 kg CO_2/kWh CO_2, 0.00006 kg CO_2eq/kWh CO_2, and 0.00280 kg CO_2eq/kWh for CH_4 and N_2O [15].

Emissions caused by Waste Treatment Units (WTUs): Several studies conducted in developed countries reported WTU-EF values between 0.047 and 4.448 [16]. Furthermore, the emission reductions and energy savings achieved through the use of recycled materials in place of virgin materials are not taken into account.

Emissions caused by anaerobic digestion: A conclusion was drawn by in relation to a specific case study of cereals in Umbria, Italy [17]. The biomethane chain exceeds the minimum greenhouse gas reduction (35%), mainly due to the open storage of digestate. A common way to improve greenhouse gas reductions (up to 68.9%) is to harness heat and electricity from biogas cogeneration plants and jacket fermentation residue storage tanks [18].

Total greenhouse gas emissions from biogas energy production are generally calculated in the range of 0.10 kg CO_2eq/kWhel to 0.40 kg CO_2eq/kWhel. This translates to 22%-75% less greenhouse gas emissions than, for example, Germany's current energy mix [19].

Emissions caused by composting: Compost production requires energy, machines are required for crushing and mixing raw materials and for setting up compost piles. These piles usually require rotation, forced aeration, or some form of agitation to ensure aerobic conditions are maintained. Aerobic composting quickly produces stable compost with low unpleasant odors. All the energy used in composting has associated greenhouse gas costs. For every liter of diesel fuel consumed and every kilowatt of electricity consumed, you are exposed to greenhouse gases. For example, burning 1 liter of fuel produces 2.75 kg of CO_2 [20]. This is small compared to the methane avoidance credits achieved by diverting material from landfills [21].

Emissions caused by controlled landfill sites: Landfills are the main source of CH_4 emissions in the waste sector. Poorly managed landfills that do not use gas extraction systems or simply dump waste into dug holes are common in developing countries [22]. Another study comparing greenhouse gas emissions and greenhouse gas contributions per ton of waste between different landfill structures found that emissions from sanitary landfills were 300 kg CO_2, compared to 300 kg CO_2 from public landfills. Emissions were found to be 10,000 kg CO_2e per ton and Equivalent weight per ton [23].

What is causing global warming?

The Earth's climate is influenced by many factors. These factors include the energy output of the sun (warming effect), volcanic eruptions (cooling effect), concentrations of greenhouse gases in the atmosphere (warming effect), and aerosols (cooling effect) [24].

Carbon Dioxide (CO_2) has been the largest contributor to global warming since the industrial revolution (i.e., 1750), followed by methane (CH_4). CO_2 concentrations increased by 44% from 278 ppm in 1960 ppm to 401 ppm in 2015 [25]. Since 1951, about 100% of the warming has been due to anthropogenic forcing, but more than 100% is due to greenhouse gases produced by offsetting anthropogenic aerosols. During this period, natural forcing and internal variability are considered negligible.

Future emissions pathways

There are many factors that could affect future greenhouse gas emissions. The 2013 IPCC report uses Representative Concentration Pathways (RCPs) to shift from aggressive global warming plans (RCP 2.6) to high fossil fuel scenarios (RCP 8.5) with ever-increasing annual carbon emissions. It shows a range of plausible emissions scenarios, ranging in range. Climate model projections using RCP 2.6 to RCP 8.5 range from +1.0°C (0.3°C, +1.7°C) to +3.7°C (2.6°C, 4.8°C) for a century-scale increase (between 1995 and 2090). (Average estimates for low-carbon and high-carbon scenarios with 90% confidence intervals). Note that these estimates do not include pre-1995 warming (+0.6°C). The

IPCC has generally not commented on the likelihood of these scenarios. Because it is not a 'scientific' question, but rather a 'social' one: how much reduction will society be willing to achieve in the next century? [26].

Environmental and social impacts of climate change

Climate change has many potential environmental, social and economic impacts. In most situations these effects are detrimental. Depending on the individual case, these may be cheaper (e.g., higher crop yields). As the average global temperature rises, the severity of adverse effects increases. Even if global warming were to remain at 2°C compared to pre-industrial levels, there would be adverse effects and the world would need to take appropriate measures to adapt to new climatic conditions. Despite all global efforts, once temperatures rise above 2°C, the impacts are expected to become increasingly severe, widespread and irreversible [27].

Canada has already warmed by an average of 1.5°C from 1950 to 2010. Due to climate change, extreme weather events such as heat waves, heavy rains, floods, storms, droughts and wildfires are expected to become more frequent and more severe in Canada. Below are the regions that are negatively impacted globally [28].

Floods and droughts: Floods are expected to occur more frequently on more than half of the earth's surface. May decrease in some areas. Winter is expected to see less snowfall in mid-latitude regions, resulting in less severe spring melt water flooding. In Canada, increased precipitation is projected across the country [29].

On the other hand, meteorological droughts (decreased precipitation) and agricultural droughts (dry soils), especially under RCP 8.5, are likely to affect some regions and Prolonged or frequent for some seasons. Great Britain, Columbia, Prairie. More severe droughts will put additional stress on water supply systems in dry areas, which may be manageable in wet areas if adaptation measures are implemented [30].

Reduction in water resources: Renewable water supplies are expected to decrease in certain regions and increase in others. In areas where benefits are expected, increased water flow variability (due to increased precipitation variability and increased evaporation over the season) and seasonal declines (due to less snow and ice accumulation) will reduce water Temporary shortages of resources may still exist. A warmer environment can reduce the supply of clean water and degrade water quality. For example, algae-producing toxins can affect the quality of water sources such as lakes. This overall decline in renewable water supplies will increase competition for water among agriculture, ecosystems, human settlements, industry and energy production, and threaten local water, energy and food security [31].

Rising sea levels: Fifteen of the world's 20 largest metropolitan areas are near the coast (14 in Asia), and about 200 million people live within 30 miles of the ocean. More than $1.4 trillion worth of real estate is at risk just off the coast of the United States of America, according to a Reuter's analysis. "A growing proportion of the USA population and wealth, including major USA cities and financial centers such as Miami, Lower Manhattan, New Orleans and Washington, D.C., live on or near the coast and are threatened by rising sea levels"[32].

Changes in ecosystems: Over the past millions of years, climate change has occurred naturally and slowly, allowing ecosystems to adapt. However, in the 20th century, many argue that we entered the Anthropocene. The rate of species extinction he exceeds the "normal" rate (i.e., in the absence of human influence) by a factor of 100. We are facing a major biodiversity crisis and may even face a sixth 'mass extinction event'.24]. After the 21st century, the risk of extinction for both terrestrial and aquatic species is higher in all his RCP scenarios. As early as 2050, the rapid changes currently occurring are expected to threaten both terrestrial and marine ecosystems, especially under RCP 6.0 and RCP 8.5. It can be pointed out that ecosystem change is related to more than just climate change. Mass extinctions are caused by many factors, including urbanization and global population growth. Of course, climate change is also having an effect, and it will become even greater over time [33].

Food production and security: Climate change is also a major political issue, and its impacts such as food insecurity are already causing conflict in vulnerable regions around the world. In North Africa, for example, there is growing evidence that although climate change impacts such as food insecurity were not "causes" of the 2011 Arab Spring, they may have caused the riots. Expected climate change impacts (such as extreme temperatures, floods, droughts, sea level rise and ocean acidification) will not only exacerbate existing tensions, but also pose significant challenges to domestic security [27].

Mitigation and adaptation for climate change

The IPCC report describes the effects of uncontrolled global warming. "Continued greenhouse gas emissions will lead to further warming and long-lasting changes in all elements of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts on people and ecosystems. Climate change, limiting global warming requires substantial and sustained reductions in greenhouse gas emissions, which can be combined with adaptation to limit climate change risks" [15]. Technology development is needed to reduce energy consumption in the land sector, decarbonize energy supply, reduce net emissions and improve carbon sinks.

Adoption of circular economy

The introduction of new "circular economy" approaches can also combat resource scarcity. This by definition means a resilient industrial economy. The aim is to rely on renewable energy. Minimize, track and preferably eliminate the use of toxic chemicals. Careful design eliminates waste [11].

Another area that is poised for innovation in the food sector is reducing food waste. According to the Natural Resources Defense Council, up to 40% of food is wasted, and food waste has increased by 50% since the 1970s. This means that it is possible to reduce the amount of food waste, and Impact has the potential to do so, to save money, land and energy [10].

Keeping global warming under 2°C

In Copenhagen, an international agreement was reached to limit global warming to 2°C. This RCP corresponds to a CO_2 concentration of 450 ppm (range 430 ppm-480 ppm). This scenario assumes that emissions will peak by 2020 and then decline significantly, reaching near-zero carbon emissions by 2100. The IPCC Summary for Policymakers states:

- CO_2 equivalent emissions in 2010 were 49 Gt. These should be reduced to 22 Gt by 2050. To reach zero emissions by 2100, we need to limit total emissions to 825 Gt by 2050 and 125 Gt from 2050 to 2100. To meet these 'carbon budgets' for the rest of the century, mitigation measures must focus on low-carbon power, reduced energy consumption, energy efficiency and fuel switching [15].

- Global temperature records show that the earth has warmed by about 1°C since 1900. International efforts aim to limit temperature rise to 2°C. The effects of global warming are already being felt in many regions through increased flooding, temperature extremes, droughts, hurricanes and more. As temperatures continue to rise, further deterioration is expected. The world will have to reckon with such deterioration in the coming years [15].

Human development: Improved access to education, nutrition, health facilities, energy, safe housing, settlement structures and social support structures. Gender inequality and other forms of marginalization have decreased.

Poverty alleviation: Improved access and control over local resources, land ownership, Disaster risk reduction, Social safety nets and social protection insurance system.

Livelihood security: Income, wealth and livelihood diversification, improving infrastructure, access to technology and decision-making forums, strengthening decision-making authority, change farming, ranching and aquaculture practices, dependence on social networks.

Disaster risk management: Early warning system, risk and vulnerability mapping, diversification of water resources, improved drainage, flood and cyclone shelter, building codes and building practices, storm and sewage management, improving transportation and road infrastructure.

Ecosystem management: Maintenance of wetlands and urban green spaces, coastal afforestation, management of watersheds and reservoirs, reduce other stressors on ecosystem and habitat fragmentation, conservation of genetic diversity, operation of chaos regime, community-based management of natural resources.

Spatial or land-use planning: Provision of adequate housing, infrastructure and services, managing development in flood-prone and other high-risk areas, urban planning and modernization programs in land use law and Easement protected area.

Structural/physical:

Engineered and built-environment options: Embankment and sea defense, flood embankment, water supply warehouse, improved drainage, flood and cyclone shelter, building codes and building practices, storm and sewage management, improving transportation and road infrastructure, floating house, coordination of power plants and power grids.

Technological options: New crops and animal breeds, indigenous, traditional and local knowledge, techniques and methods, efficient irrigation, water saving technology, desalination; conservation agriculture, food storage and preservation facilities, threat and vulnerability mapping and monitoring, early warning system, building insulation, mechanical and passive cooling, technology development, transfer and dissemination.

Ecosystem-based options: Ecosystem restoration, soil protection, afforestation and reforestation, conservation and reforestation of mangroves, green infrastructure (tree shade, green roofs, etc.), regulate overfishing, co-management of fisheries, supports species migration and dispersal, ecological corridor, seed banks, gene banks and other ex situ conservation and community-based management of natural resources.

Services: Social safety nets and social protection, food banks and distribution of surplus food, municipal services, including water and sanitation, vaccination program, essential public health services and improving emergency medical services.

Institutional:

Economic options financial incentives: Insurance, destructive bonds, payments for ecosystem services, water pricing to promote universal supply and wise use, microfinance, disaster relief funds, remittances and public-private partnerships.

Laws and regulations: Land use law, building standards and practices, easement, water regulations and agreements, legislation supporting disaster risk reduction, laws promoting the purchase of insurance, defined property rights and land security, protected areas, catch quotas, patent pools and technology transfer.

National and government policies and programs: National and regional adaptation plans, including mainstreaming, local and regional adaptation plans, economic diversification, urban modernization program, municipal water management programs, disaster planning and preparation, integrated water resource management, integrated coastal zone management, ecosystem-based management and Community-based adaptation.

Social:

Educational options: Awareness and integration into education, gender equality in education, consulting services, exchange of indigenous, tradition and local knowledge, participatory behavioral research and social learning and Knowledge sharing and learning platform.

Informational options: Risk and vulnerability mapping, early warning and response system, systematic monitoring and remote sensing, climate service, use of indigenous climate observations, participatory scenario development and Integrated evaluation.

Behavioral options: Create a budget and evacuation plan, migration, soil and water protection, runoff discharge of rainwater, diversification of livelihoods, change farming, ranching and aquaculture practices and dependence on social networks.

Spheres of change:

Practical: Institutional and administrative changes that lead to social and technological innovation, changes in behavior, or substantial changes in outcomes.

Political: Political, social, cultural and environmental choices and actions are aligned to reduce vulnerability and risk and support adaptation, mitigation and sustainable development.

Adaptation of climate change effects on the waste sector

Compared to other fields, the importance of sustainable waste management for climate protection may seem relatively simple. However, mitigation measures in the waste sector can have a significant impact on greenhouse gas emissions generated and reported in other sectors such as energy and industry. International and national efforts towards climate-friendly waste management must follow the waste hierarchy. It prioritizes waste prevention, reuse, recycling (including composting) and energy recovery from waste before landfill and open-air landfill or incineration [25]. The Global Waste Management Outlook estimates that improved waste management using a life cycle assessment approach could reduce global greenhouse gas emissions by about 10%-15% [10].

Solid waste management and environment

Nature exists in a state of balance. Humans' greatest challenge is not to exploit nature, but to maintain this vital balance in doing so. Massive exploitation of the earth's crust has put at humankind's disposal countless natural resources, but they are constantly converted into products and disposed of as waste once their purpose has been served. Unfortunately, it is impossible for humans to return these waste products to their raw state in the earth's crust. Therefore, the easiest escape route is to release these substances into the atmosphere in gaseous form. The accumulation of these gases in the atmosphere over the years has upset an important balance in nature (Figure 1) [19].

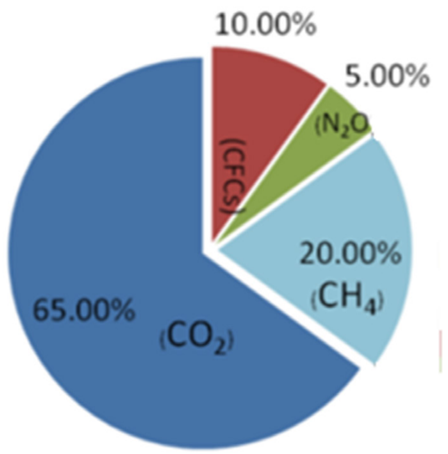

Figure 1: Contribution of different gases to global warming. **Note:** (■) CO_2; (■) CFCs; (■) N_2O; (■) Energy Production; (■) Enteric Fermentation; (■) Rice Cultivation; (■) Wastes; (■) Landfill; (■) Biomass Burning; (■) Urban Wastewater

Waste management options such as landfill, composting, incineration/mass incineration, and anaerobic digestion/biogas plants collectively emit large amounts of greenhouse gases. Composting utilizes microorganisms to oxidize biodegradable waste (particularly food and garden waste) to CO_2 and water vapor using atmospheric oxygen as an oxidant. Anaerobic decomposition converts biodegradable carbon into biogas. Biogas is composed of approximately 65% CH_4 and 34% CO_2 with trace amounts of other gases. In landfills, microorganisms slowly decompose organic matter over time, producing approximately 50% CH_4 and 50% CO_2, and trace amounts of other gaseous compounds. Methane emissions from landfills are the largest source of greenhouse gas emissions from the waste sector, contributing about 700 million tons of CO_2eq in 2009, followed by incineration, with about 40 million tons of CO_2eq. is estimated to result in (UNEP, 2009).

Managing and utilizing solid waste

Reducing greenhouse gas emissions from the waste sector can improve public health. Improve quality of life. Reducing local air, water and soil pollution while providing livelihood opportunities for the urban poor. By using existing technologies to reduce methane emissions from landfills, cities need to take advantage of low-hanging fruit to meet emissions reduction targets. Low- and middle-income countries have the best opportunities to improve waste collection rates, build and maintain sanitary landfills, recover materials and energy through higher recycling rates, and adopt Waste-To-Energy (WTE) technologies. All city resource managers should consider options such as reduction, reuse, recycling and energy recovery in the waste management hierarchy (Figure 2) [25].

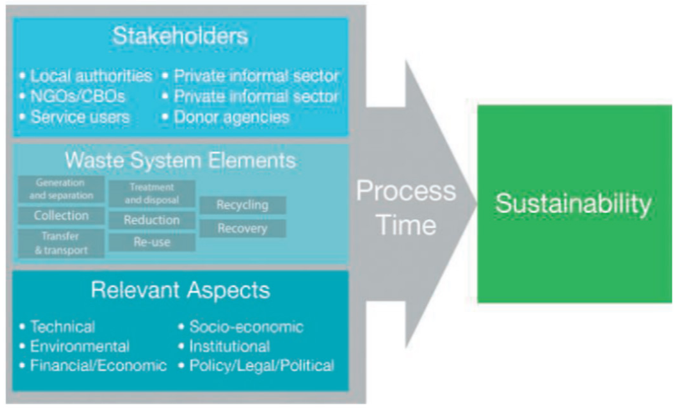

Figure 1: integrated sustainable waste management.

CONCLUSION

To logically summarize the above, the increasing proportion of greenhouse gases in the Earth's atmosphere is causing climate change, and some of these changes are due to solid waste. The manufacture, distribution and use of our products and the disposal of the resulting waste emit greenhouse gases. Waste prevention and recycling are real ways to mitigate climate change. Greenhouse gases are emitted at almost every stage of waste management. Therefore, developing appropriate disposal methods from source to landfill is essential to reduce the environmental impact. Man-made greenhouse gases certainly contribute to climate change. Greenhouse gases have therefore been a focus of research since the early 20^{th} century. The Intergovernmental Panel on Climate Change (IPCC) says global temperatures will rise by 6.4°C in the 21^{st} century unless action is taken to halt the steady rise in greenhouse gas emissions.

A review of research on the impact of solid waste on greenhouse gas emissions includes energy production from landfill gas recovery, landfill bioreactors, aerobic composting systems, anaerobic digesters, incineration with energy recovery, and waste management such as RDF. Technology has been shown to be important. Furnaces in cement kilns are being developed in several countries to reduce greenhouse gas emissions in this sector. Policies such as limiting uncontrolled landfills in some developing countries. Phased reduction of waste sent to landfills within the European Union. Incentives for energy production from landfill gas recovery in the UK. To achieve this goal, the United States of America is also introducing landfill gas recovery requirements at large landfills.

In addition, the effects of algal density and the type of algae used were studied in detail, leading to a comprehensive understanding of the interplay between algal biomagnification and contaminant uptake mechanisms. Algal phytoremediation was investigated in different locations with different algal compositions and densities.

In addition, various algal bioaccumulation factors have proven successful in detoxifying water and wastewater from arsenic and boron contamination.

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