Community Environmental Working Group

"Striving for Continuous Environmental Improvements at Intel"

DETERMINING STACK HEIGHT AT INTEL: A JOINT SUMMARY OF COMMON GROUND AND DIFFERING VIEWS

June 18, 2008

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Community Environmental Working Group

DETERMINING STACK HEIGHT AT INTEL: A JOINT SUMMARY OF COMMON GROUND AND DIFFERING VIEWS[1]

BACKGROUND

Intel is installing two Munters pollution abatement oxidizers in 2008 and will add three additional units in about five years. These will be located together to enable redundant operations and will act in unison to treat VOC emissions. When complete, the suite of five thermal oxidizers will have 10 stacks. Construction on the first two is currently underway.

Air quality standards can never be set perfectly for all pollutants in all combinations. As legal limits are set lower, effects of emissions are smaller and smaller. The technical and legal steps are slow and unending to set national standards that assure pollutants in all mixtures have zero effect on all individuals. In other words, as we reduce population exposures, it becomes harder to find any remaining health effects associated with pollution, because the remaining effects do not stand out as clearly from other sources of health deterioration. To make faster progress, the CEWG works to achieve continuous environmental improvements.

As long as ambient air quality standards are met there is no other regulation that dictates stack height, so Intel had to determine how high to build the stacks. Concerns regarding the stack heights of the Munters units were raised during the air permitting process and then brought to the CEWG for discussion. The CEWG along with Intel agreed that this would be a good project to evaluate for continuous environmental improvements. Intel agreed to get a recommendation from the CEWG to take back to management for their consideration. The Group then established a stack height committee to study this issue. A chronology of activities related to this recommendation appears as Appendix A.

Industrial stack design is a complex engineering process. Stacks enable emissions to mix with air, spreading and diluting the concentration of emissions that reach ground level in any one place where humans may live and work. Evidence shows that, in general, the higher the stack, the greater the mixing, with diminishing concentrations as stacks get higher and higher. But adding a little to a short stack helps more than adding the same amount on a taller stack. The dilution is influenced by height

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of the stacks, the temperature and volume flow rate of gases emitted from the stack, the heights and locations of nearby buildings and the meteorological conditions that occur during the dilution.

The CEWG recommended that the height of the new Munter stacks be at least 38.2 and preferably 40 meters from the ground, substantially higher than that of the existing Durr units. In the end, Intel management decided to increase stack height from the originally planned 23.2 meters to 30, which is seven meters higher than planned RTO stacks, but 8.2 meters lower than the CEWG recommendation.

Representatives from Intel and the CEWG had two meetings (about 3.5 hours total) to discuss this decision, lessons learned from this endeavor, and the future relationship between the CEWG and Intel. These meetings took place on April 18 and May 12.

This report is a result of these meetings and a joint drafting process. The CEWG and the members of Intel's management who participated are all in agreement with this report as a summary of positions, rationales, lessons learned, areas of agreement and disagreement. Though they do not entirely agree on all points, management representatives and members of the CEWG do acknowledge that this report accurately reflects one another's opinions and rationales as explored in their meetings.

This report is designed to provide the public with a clear and accurate overview on the stack height project to date. The CEWG recommendation and the management decision must be understood within the context described here. Taking any part of this report out of context would do a disservice to ongoing public education and effective dialogue.

RATIONALE FOR CEWG RECOMMENDATION
38.2 – 40 meters

The CEWG based its recommendation largely on modeling results demonstrating that higher stacks are expected to create greater dispersion under normal and downtime conditions. The committee set a 40% or better reduction in concentration at the maximum point as a target for determining stack height.

The Group also felt that it would be prudent to select a level above the height of the tallest building, specifically, the 5 story office building to the northwest. Consequently the subcommittee recommended a height of at least 38.2 meters.

Although some participants preferred 40 or 43.2 meters, the 38.2-meter recommendation was forwarded because (1) Munters units are presumably more reliable and have fewer unscheduled downtime periods, (2) redundancy will be provided during scheduled downtimes, and (3) the probability is very low that the units would go down during the worst-case scenario on which the 24-hour modeling averages were based.

The CEWG examined simulated photographs of the stacks at the proposed level and judged 40 meters aesthetically acceptable, but the Group was also clear that at this level, air quality should be a higher priority than looks.

RATIONALE FOR INTEL DECISION
30 Meters

The cost for higher stacks was not an issue for management. Its chief concern was balancing two interests—air quality and aesthetics. The trade-off between these two objectives is not insignificant. A person's tolerance for or interest in taller stacks will depend on health issues, location, and personal values.

Managers agreed from the modeling that higher stacks would help reduce ground level plume concentrations, but they also determined from previous studies and community feedback that many people are concerned about the visual landscape, especially on the east slope overlooking Corrales. Because of these concerns, they decided to conduct a balloon-assisted test.

Tethered balloons were positioned under controlled conditions at the location where the Munters units will be installed at the plant, and photographs were taken from various vantage points to determine actual visual heights. In addition, Intel produced simulated photographs of the support structure around the stacks at these heights. These photographs were more accurate than the ones previously viewed by the CEWG, the previous photos being quite misleading in giving a true visual representation, mainly because of uncertain viewing angles. Based on this evidence, Intel judged that the recommended height of 38.2 meters would be visually unacceptable to many neighbors.

Intel also took into consideration the possibility that emission levels may be too close to standards for particulate matter. Managers concluded that this would not be a problem because Intel has always operated the equipment identified in the permit well below the level of operations assumed by the model. Because the modeling trended toward worst-case or maximum-possible values and Intel wanted to balance concerns regarding aesthetics, management felt that a compromise of 30 meters was warranted.

In sum, management felt that the totality of changes, including new redundant units and increased stack height, is a step toward continuous environmental improvement. Further, stack testing will be conducted on the new Munters units to verify that actual emissions are at or below what was modeled.

RESPONSE TO INTEL DECISION

CEWG members disagree about whether the proposed configuration with 30 meter stack heights will meet the fine-particle ambient standard. Some feel that the approximate 20% reduction afforded by the 7 meter increase in stack height and the conservatism in modeled emissions will ensure that the fine-particle standard will be met despite the year-to-year changes in meteorology or any increases in

fine-particle emissions from non-Intel sources. Others are concerned that the non-Intel sources are several years out of date and that the rapid growth in the area will produce higher concentrations associated with non-Intel sources. They also believe that year-to-year variations in meteorology can be expected to produce annual-mean fluctuations in concentration in the 20 to 30% range. Consequently, they feel that compliance with the fine-particle standard is not assured. They understand that some of the sources that were modeled are no longer operating, some operate seasonally and others have conservative emissions, but they cannot assess the degree of conservatism in the modeling without further modeling efforts to quantify how much conservatism is actually built in to the model estimates. Additionally, some continue to worry that Good Engineering Practice (GEP) was not used to help determine stack height. GEP is a rule of thumb to avoid the effects of building downwash.

For these reasons, certain participants question whether 30 meters constitutes a true environmental improvement. Some are concerned as well that the 30-meter height is not a good compromise, as it favors aesthetics over environmental improvement, and, they say, community aesthetic concerns were never adequately documented. Indeed, some note that the diminishing returns of increased height did not occur at even the highest model levels studied (43 meters) by the CEWG and Intel management.

There are ways to resolve these conflicting opinions: (1) modeling could be done with more realistic assumptions to study the significance of the conservatism, (2) the growth of activities (diesel truck traffic, for example) associated with non-Intel sources could be examined, (3) measures could be taken to improve the dispersion characteristics of other Intel sources (are the rain caps really necessary?), and/or (4) the role of the trend in reduced fine-particle emission precursors could be examined in detail. The new modeling would need to take into account any new sources that might be added as Intel gears up the new production facilities on the south side of the facility.

THE LARGER CONTEXT

Intel's plan involved placing all the new thermal oxidizers (RTOs) close together and oversizing them so that if one went down the others could treat the redirected material. The additional capacity will come at the cost of approximately 2 million dollars. The RTOs burn about 97% of the material and, consequently, release much lower quantities of hazardous materials. The new oxidizers will have a higher reliability so that the frequency of releases of untreated emissions is significantly reduced.

Scheduled and unscheduled downtime is a critical consideration, and emissions used to go unabated during these periods. However, the new Munters units will provide full redundancy during scheduled downtimes, which will greatly improve the quality of emissions when the units are shut off for maintenance. Further, Munters have a significantly lower unscheduled downtime rate than do the existing Durr units, resulting in improved emissions overall.

The CEWG relied heavily on modeling results, and management looked at the same results as part of its decision-making process. The model assumes maximum allowable or permitted levels of operation, meaning that simultaneous and continuous operation 24 hours a day, 7 days a week, and 365 days a year of all equipment, but actual operations fall well below model assumptions. Intel has never operated all the equipment identified in the permit as is assumed by the model. Further, Intel has shut down two factories, which means equipment is no longer operating.

Modeling for the site has been done for this new cluster and are the new basis of future improvements in considering dispersed stacks and other modeling effects discussions with the CEWG. Munters RTO stack heights will be 30 meters tall. However, future stacks could be increased if new persuasive evidence emerges.

LESSONS LEARNED

The 30-meter decision was not satisfactory to everyone involved, but representatives from Intel management and the CEWG agreed that they learned important lessons in the process of studying this issue:

- Everyone should pay careful attention to communication among Corporate Affairs, Site Operations, project managers, the CEWG, and the public. For example, some managers were not fully aware of what the CEWG was doing, and work proceeded before the recommendation was reviewed.

- The amount and quality of information, including the timing of this information, is critical. The initial pictures viewed by the CEWG were misleading, and the committee failed to seek modeling information about clustering effects as part of the initial effort.

- Input from the community on all factors must be sought. The CEWG was unaware of the existence of information about community concerns related to the visual landscape of the east slope.

- Recommendations on specific issues must be studied within a larger history and context. No clear timeline of continual improvements has been kept, and the CEWG may have been too focused on stack height without keeping other related concerns in mind.

- CEWG efforts and the project schedule must be carefully coordinated. Although the CEWG met the deadline provided by Intel representatives, work had already started on the project.

- Timelines and schedules must be carefully managed in order for participants to get necessary information, study the issue, give careful consideration to various alternatives, and meet schedule needs. The CEWG always felt pressured for time and admitted in the

end that it did not have sufficient time to get all of the data it would have liked to have. In retrospect, the request for a recommendation probably should have come earlier.

- Both management and the CEWG must think through the unintended consequences of well-intentioned actions. For example, stacks were planned to be clustered to provide necessary redundancy, but this could cause increased emissions concentrations requiring higher stacks. Higher stacks intended to protect air quality could further impact the western views of Corrales and elicit complaints from neighbors.

- The community needs to be educated about the issue and its larger context. People who complain about visual aesthetics may not be aware of good reasons for higher stacks and vice versa.

FUTURE INTERACTION

In their meetings, representatives from management and the CEWG agreed to have continued dialogue. The CEWG and management should meet occasionally to explore mutual and separate concerns and areas of common ground. Management agreed to meet with the CEWG whenever major changes affecting the environment are planned.

It is necessary for a good, clear process to be established for this communication, and the CEWG needs to work on such projects as a group and to communicate with a common voice. This does not mean that members of the CEWG should always agree. Indeed, exploration of differences is vital. Areas of agreement as well as disagreement should be expressed in various reports that the Group produces.

On future projects of this nature, several objectives need to be met:

1. The role of the CEWG and expectations for interaction between management and the CEWG must be clearly defined.

2. Get as much information as possible early in the work. This includes the broad context and history of related developments, expanded modeling information as necessary, and improved information about community quality-of-life concerns.

3. The work should be deadline driven, but those involved should manage timelines in a way that ensures careful consideration of information and options.

4. Intel should formalize an improvement orientation by using measurement to demonstrate improvement; communicating the whole picture of improvement, in which everything counts; and show incremental improvement over time.

5. Optimize communication by meeting with management at the earliest possible time to clarify expectations, discuss goals and constraints, explore information, and discuss differences openly.

Appendix A

CEWG
Stack Height History & Chronology

September 19, 2007	Regular CEWG meeting	Fleming and Chavez presented a report on site operations and new processes, indicating that a technical permit revision would be required for new stack locations, different stack parameters, and different operating temperatures. They announced an open house to occur on October 15. Kinis asked if stack heights could be increased. Chavez said this could be looked into.
October 17, 2007	Regular CEWG meeting	Bartlit reported that there was considerable discussion about stack height at the open house. Environmental improvement and aesthetics were mentioned in the ensuing discussion.
November 19, 2007	Regular CEWG meeting	The Munters stack height was discussed, and Chavez indicated that Intel would consider a new height once the group reached consensus on what this height should be. Considerable discussion ensued. The group appointed a committee to study this issue. The committee would include Williams, Church, and Pineda.
December 19, 2007	Regular CEWG meeting	A panel consisting of Hugh Church, Mike Williams, and Ralph Williams presented a primer presentation on air dispersion modeling in preparation for looking at the stack height modeling as part of the CEWG study of this issue. The group generated a set of issues to be

		addressed by the committee: cold plume effects, terrain effects, building effects, modeling accuracy, stack-grouping effects, good engineering practice, wind-direction effects, and thermal oxidizer downtime issues. Kinis was added to the committee. Ralph Williams agreed to serve as resource person. Chavez agreed to represent Intel.
January 7, 2008	Meeting of stack height committee	The committee set its goal and discussed abatement efficiency, downtime, weather data, calculated stack heights (GEP), and stack grouping effects.
January 10, 2008	Meeting of stack height committee	Chavez reported that the CEWG would need a recommendation by the end of February. The group discussed building ventilation, stack height effects, abatement downtime issues, weather data, and possible options. A criterion level of 40% reduction of emissions at maximum point of concentration was set. This included 30% as a target plus 10% to compensate for lack of adequate weather data and other possible factors.
January16, 2008	Regular CEWG meeting	Stack height committee gave an interim report. February 20 was set as the date for generating a final recommendation. Chavez said this was necessary to allow sufficient time to make engineering revisions. Considerable discussion of stack height issues ensued. The group discussed weaknesses in the meteorological modeling data and explored several options for how to deal with this. The group agreed to meet the February deadline and to base its recommendation on the use of existing weather data, but to leave open the option of revising this recommendation in the future pending more inclusive data. Gallegos announced that Intel would install two

		Munter units in 2008 and that one of these would provide redundancy.
January 24, 2008	Stack height committee meeting	The group reviewed modeling data and generated its first draft recommendation.
January 31, 2008	Stack height committee meeting	The group reviewed new data and revised its draft recommendation. This draft was revised through email and by telephone through six versions.
February 13, 2008	Stack height committee meeting and numerous email and phone interactions.	The committee reviewed new data and generated its final draft recommendation for the CEWG.
February 20, 2008	Regular meeting of the CEWG	The stack height committee presented its recommendation. Considerable discussion ensued, and the CEWG generated its recommendation to Intel. This recommendation was refined after the meeting through email and telephone interaction.
March 19, 2008	Regular meeting of the CEWG	Gallegos presented a stack height update, indicating that pre-work on a final decision was still underway and that a formal presentation of the CEWG recommendation had not yet taken place. He agreed to set up a meeting at which Edward Pineda, John Bartlit, and Mike Williams would participate in this presentation to management. He agreed to look into whether members of the public might also attend.
April 16, 2008	Regular meeting of the CEWG	Gallegos presented an update in which he announced management's decision to set the stack height at 30 meters. After considerable discussion, the group decided to (1) ask for an immediate meeting with management to review and possibly revise this decision, (2) ask for new modeling to compare clustered-stack with separated-stack conditions, and (3) invite management to have a dialogue with the CEWG and public at a subsequent meeting.

April 18, 2008	First meeting with management	Mike Williams, Edward Pineda, Hugh Church, and John Bartlit met with Jami Grindatto, John Painter, Sarah Chavez, Teresa Fleming, and Frank Gallegos.
May 12, 2008	Second meeting with management	The same group met again to continue the dialogue, discuss the ongoing relationship between the CEWG and Intel management, and determine next steps.

Appendix B

Letter sent from acting chair John Bartlit to Intel management, April 17, 2008:

To the Site Management Team:

The Community Environmental Working Group was extremely disappointed to learn at our meeting yesterday that you have selected the height of the new Munters RTO stacks at 30 meters, which is substantially less than our recommendations.

These recommendations resulted from concentrated work by the entire CEWG and a subcommittee over the better part of three months. The committee of six included three individuals with substantial experience in air dispersion modeling.

Members expressed two general concerns after learning of your decision. The first is that the 30-meter height may not result in continued improvement (see second request below), which is our group's stated mission. The second concern is that the management team may not have considered the potential negative impact of their decision on the constructive relationship that the CEWG and Intel have worked so hard to build over the past four years. The latter is a special concern since we had requested and were led to believe that our representatives would attend and help present our recommendations at your meeting.

Therefore, we make three requests:

First, we appeal for you to reconsider your decision pending a meeting with representatives from our group. We would like to explain the basis of our recommendations and our current concerns about your decision, and we would like to learn more about the rationale for your decision. Because this meeting will need to occur quickly, we are prepared to meet with you at your earliest convenience. Our representatives will include Mike Williams, Hugh Church, Edward Pineda, and myself. Our facilitator Stephen Littlejohn will also attend. A community member Lynne Kinis is also available to attend if the meeting occurs offsite. Please let Frank know times when this meeting might occur and where you would like to meet. We would like to have this meeting soon even if the decision is unchangeable.

Second, we request additional modeling to compare results in two cases—(1) when stacks are widely separated (the current arrangement) and (2) when stacks are clustered (new arrangement). Clustering will change modeling results and could make air quality impacts of clustered, moderately taller stacks worse than

impacts from the separated, shorter stacks. Our group would like to look at these modeling results. The new modeling would need to be done right away so the results would be available at our meeting.

Third, we would like to invite your team to the May meeting of our group, or a later meeting, to have a dialogue about our goals and Intel management considerations. The dialogue would be aimed at mutual learning and relationship building, again a basic purpose of our work. We realize that this would occur after your final decision is made.

A final point: We understand a major factor in Intel's decision for a moderate stack height is potential public complaints about the appearance of taller stacks. The CEWG formally agreed in Wednesday's meeting it has a responsibility to respond to any such complaints. The visual appearance was considered in our deliberations and is documented in meeting summaries. We are prepared to communicate this history and rationale to the community in general and to concerned individuals. Again, improved, detailed public dialogue is in our mission.

Thank you, and we look forward to hearing from you. Frank and Sarah are prepared to fill in the details of our requests.

- John Bartlit, Acting Chair
  On behalf of the Community Environmental Working Group