HPVIS Research Project Final Report
Utilization of the USEPA High Production Volume Information System (HPVIS) to Prioritize Chemicals for Additional Public Health Follow-up

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Abstract

The New Jersey Department of Health and Senior Services (NJDHSS) utilized the High Production Volume Chemical Information System (HPVIS) to address specific community health concerns from the state and local government perspective. The HPVIS system was utilized to help prioritize chemicals for additional follow-up and evaluation. Facilities using chemicals selected for additional follow-up, based on the HPVIS data, were mailed a chemical handling and use survey. This survey information allowed our program to develop recommendations to reduce exposure to these chemicals within the workplace and the community.

Executive Summary

Chemicals that have been the subject of public inquiry within our agency were evaluated to help prioritize the chemical use issues that would be targeted for follow-up action. The ability to cost-effectively screen chemicals is a crucial component of the NJDHSS occupational health evaluation effort because it helps utilize our resources in the most effective manner to serve the public. The set of chemicals that have been part of pubic inquiries at NJDHSS were matched with the HPVIS database, the Community Right-to-Know (CRTK) database, the Section 313 chemical database, an the Association of Occupational and Environmental Clinics (AOEC)/Occupational Asthma registry database. The toxicity of each of these chemicals was then summarized using the HPVIS and a priority ranking was given to each chemical based on the acute mammalian toxicity and potential for reproductive effects. The distribution of acute toxicity endpoints among this set of chemicals was used to distinguish each of these chemicals of interest as high, medium, or low priority for follow-up investigation. Chemicals that were present in the HPVIS system and at least one other data source that had moderate to high acute mammalian toxicity or potential reproductive effects were selected for further evaluation. Facilities identified within specific communities that use at least one of these chemicals were sent a chemical use survey, previously developed by Lefkowitz et al. (2004) to evaluate the handling and usage of the High Production Volume (HPV) chemical and to assess exposure potential among the employees working within the plant or individuals living in very close proximity to the facility.

Methods & Chemical Selection

A review of phone logs from the Occupational Health Service at the NJDHSS revealed that 16 chemicals have been the subject of specific inquiry regarding safety and health issues from workers at various industrial facilities. Often, the location and identity of the industrial facility and the identity of the caller are not given during the phone conversation. Anonymous complaints and inquiries are permitted by the NJDHSS phone duty standard operating procedure. These 16 chemicals are listed in table I.

Following the determination of these 16 chemicals of interest, the NJDHSS obtained three other database lists from other state agencies or professional organizations. This included the Section 313 chemical database list, the Community Right-to-Know

(CRTK) database, and the AOEC/asthma registry list. All three databases were linked to the HPVIS to determine which chemicals were present in some or all databases (Table I).

Table I - Chemical Selection and Data linkage for 16 chemicals of interest.

Chemical name & CAS #	**Section 313 list**	**CRTK list**	**AOEC/ asthma registry**	**HPVIS system**
chloroprene (126-99-8)	X	X		
Iron pentacarbonyl (13463-40-6)	X	X		
ethyl acrylate (140-88-5)	X	X		
butyl acrylate (141-32-2)	X	X		
Methyl isocyanate (624-83-9)	X	X		
Benzene (71-43-2)	X	X		
ethylene oxide (75-21-8)	X	X	X	
phosgene (75-44-5)	X	X		X
acrylamide (79-06-1)	X	X		X
acetic acid (64-19-7)			X	X
hexadecafluoro heptane (335-57-9)				X
phthalic anhydride (also called 1,3-isobenzofurandione) (85-44-9)	X	X	X	X
tetrachlorophthalic anhydride(also referred to as 1,3-isobenzofurandione, 4,5,6,7 tetrachloro) (117-08-8)			X	X
triethanolamine (also called ethanol-2, 2', 2"-nitrilotris) (102-71-6)			X	X
Hydrogen Sulfide (7783-06-4)		X		X
tricarbonyl [(1,2,3,4,5-.eta.)-1-methyl-2,4-cyclopentadien-1-yl]-Manganese (also referred to as MMT) (12108-13-3)		X		X

Chemicals that meet the criteria of being in the HPVIS and at least one other database included: phosgene, acrylamide, acetic acid, phthalic anhydride, tetrachlorophthalic anhydride, triethanolamine, hydrogen sulfide, and MMT.

The HPVIS data was then used to summarize and describe the acute mammalian toxicity of each compound and potential reproductive effects based on the studies submitted to the high production volume challenge program. The focus on acute mammalian toxicity and reproductive end points was due to the nature of the public inquiries at NJDHSS for the chemicals that meet the criteria described above, which typically involved questions from the public regarding spills or particular reproductive health concerns. The cut-points were generally defined by natural breaks in the data for each of the chemicals. In addition, if reproductive effects were noted at fairly low concentrations, they were also accounted for in the categorization of a particular chemical because this is often a concern of workers that consult the occupational health service unit. Some data units had to be converted for comparison purposes. The toxicity data are detailed below in Table II. The data in Table II is difficult to evaluate because of the variable nature of the testing that has been performed, since some chemicals have only had inhalation studies and some have only had ingestion or dermal studies. However, it can be seen that there are chemicals that have LC50 values below 1 mg/L and those above 1 mg/L, as a natural break in the data. It can also be seen that for chemicals with LD50 values, there are those below 300 mg/kg and those above 1, 000 mg/kg. There are also two chemicals that have subtle reproductive effects. These apparent breaks in the data distribution were used as guidance for making a judgment about how to categorize each of these chemicals for additional follow-up and survey. Chemicals with LC50 values below 1 mg/L or LD50 values below 300 mg/kg were considered a high priority, while values above these cut -points were considered lower priority for follow-up. Chemicals that have any reproductive effects noted in HPVIS had their priority ranking increased to account for this potential effect.

Table II - Toxicity Data abstracted from HPVIS for chemicals meeting criteria for further evaluation.

Chemical name and CAS #	Mammalian acute toxicity	Reproductive effects noted	Priority	notes
phosgene (75-44-5)	LC50 = 0.049 mg/L	No	high	
acrylamide (79-06-1)	LD50 = 203 mg/kg	No	high	
acetic acid (64-19-7)	LD50 = 4960 mg/kg	No	low	
phthalic anhydride (85-44-9)	LOEL = 25, 000 ppm food	Yes	moderate	0.001 mg/L subtle repro effects noted (sperm motility decrease)
tetrachlorophthalic anhydride (117-08-8)	LDzero = 15, 800 mg/kg	Yes	moderate	1500 mg/kg subtle repro noted (sperm motility)
triethanolamine (102-71-6)	LD50 = 7390 mg/kg	No	Low	

Hydrogen Sulfide (7783-06-4)	LC50 = 370 mg/L	No	moderate	
tricarbonyl [(1,2,3,4,5-.eta.)-1-methyl-2,4-cyclopentadien-1-yl]- Manganese (12108-13-3)	LC50 = 0.247 mg/L LD50 = 58 mg/kg	No	high	

Six of the chemicals in Table II were either high or moderate priority for additional follow-up. The Section 313, CRTK, and AOEC/asthma registry lists were then utilized to determine if workplaces using any of the six chemicals could be identified. Of the six chemicals in Table II identified as a moderate or high priority for follow-up action, four chemicals were found to be used in New Jersey among a total of 46 companies. This included a total of nine companies identified as users of acrylamide, ten companies as users of hydrogen sulfide, three companies as users of phosgene, 23 companies as users of phthalic anhydride, and one company that used both phosgene and phthalic anhydride. These companies were then sent a validated mailed survey to gain further information about the use, handling, and potential exposures among workers within the industrial facility.

Survey of Targeted HPV chemical users

A validated chemical handling survey was then utilized to collect additional information on the use of these chemicals at the 46 identified companies and determine the potential for occupational exposure to workers. The mailed survey was a modified version of the tool developed by Lefkowitz et al. (2004). The information collected in this survey can be used for hazard surveillance. The validated survey tool described in this step has been used by NJDHSS previously to survey industries in New Jersey about chemical usage, handling, controls, and hygiene practices.

This survey tool consists of questions in several broad categories, with descriptors that are useful for assessment and evaluation of facilities using HPV chemicals. The questions on the survey are in five broad categories that include:

- basic facility descriptions;
- operational descriptions;
- material handling descriptions;
- usage descriptions;
- engineering and personal exposure control measures descriptions.

This survey has been shown to be an effective tool in the collection of a large amount of detailed information without the need to expend a large amount of resources.

Results

This HPVIS project can be broken down into three separate evaluations, the first is associated with the data and information provided by HPVIS, the second associated with the HPVIS web-based database itself, and the third associated with an evaluation of the survey results collected on HPVIS chemicals. The NJDHSS found the HPVIS to provide some benefits for public health purposes but also found some limitations.

HPVIS Data

The HPVIS system provided toxicity data in a format that allowed fairly rapid access to summary information about a particular chemical, which was very useful. The HPVIS system also provided useful toxicity data that assisted us in developing priorities for follow-up actions and evaluations to address the chemical concerns of workers and citizens in our state. However, interpretation of the information contained within the HPVIS system does require a background and experience with animal testing protocols. This is a significant limitation and therefore we recommend that toxicologists at USEPA provide easy to read interpretative summaries on the chemicals in the database so that the information may be understood and put in perspective for non-toxicologists. In addition, the diverse array of tests listed within the HPVIS also provided some challenges in prioritizing the chemicals of interest for our project. When prioritizing chemicals comparisons between the chemicals must be made, which is difficult when the animal tests present in the HPVIS database are very different. For example, a sub-chronic feeding study is not directly comparable to a range finding inhalation study. As a result, staff focused on the professional judgment component of these evaluations, which utilized the summary toxicology data provided by HPVIS, to prioritize the chemicals. The summary information provided by HPVIS was crucial and helpful for prioritizing these chemicals, but HPVIS could not be used alone to make the priority determinations.

Database System

The NJDHSS utilized the HPVIS database in early October to meet the deadlines for this project. We have had several conversations and provided feedback to EPA and TURI regarding the HPVIS project, with some of our suggestions being incorporated into modifications of the HPVIS system. As of the last date of our use of the HPVIS system in early October, we identified several issues regarding the HPVIS database that limited its use for public health purposes. They are identified below:

- There is no listing of the chemicals in the HPVIS system anywhere on the web site or their associated CAS #'s or their associated chemical category.
- The search mechanism of the database requires that the chemical name be listed exactly as found in the HPVIS database. The database uses the Ninth Collective Index chemical name. The requirement for an exact name match is a serious flaw in the system. Conversely, Chemical Abstract Service (CAS #'s) can be used. The system does have a drop down menu of CAS #'s and matching chemical names. However, one needs access to and knowledge of these codes to input into

the system. Awareness of these codes and their use is not widespread in the public health community.

- The web site is misleading in that the use of the word "and" in the query tool, which implies that you must know all parameters to execute a search of the system. It is unlikely that anyone outside of the HPV program would know the name of the consortia or company that submitted information.
- Some common HPV chemicals that are extremely toxic are not currently entered into the system (e.g. Ethylene oxide or benzene). These chemicals may have been sponsored through the OECD HPV SIDS Program or the ICCA HPV Initiative. HPV chemical lists with the status of the chemicals sponsorship are posted on EPA's HPV Challenge Program website.
- The HPVIS system occasionally provides "study" information in the toxicology section that is blank. The chemical is listed but no data is located within the file presented on the screen. In addition, occasionally the system presents toxicity data in a language different then English, for example several submissions list "study" information in German.
- Test plans can be viewed through the HPVIS standard query .
- Units listed within the HPVIS system are not consistent and therefore require manual conversions to compare the data from different studies.
- The user of this system must be familiar with toxicology and animal study protocols. This is currently not for general public use.

Survey Data

A total of 28 chemical handling surveys were returned, resulting in a response rate of 61%. Of the surveys that were returned, 16 were users of phthalic anhydride. This included one facility that used only small quantities in their chemical quality control laboratory, 3 facilities that only stored or transferred phthalic anhydride, two facilities that reported they no longer used this chemical, 8 facilities that used phthalic anhydride as a reactant that is consumed during chemical synthesis or processing, one facility that reported phthalic anhydride as an impurity in some raw materials it uses, and one facility that mixes or blends phthalic anhydride with other chemicals. Seven of the surveys returned were from users of acrylamide which include 3 facilities that reported acrylamide as an impurity in other products used at their site. Three other facilities reported that they used acrylamide as a reactant in chemical processing and one facility reported that acrylamide is stored on site as a warehouse transfer site. Four surveys were returned from users of hydrogen sulfide, with two facilities reporting that it was used as a reactant in chemical processing, one facility reporting that hydrogen sulfide was a waste byproduct from refining, and one facility reporting that small quantities are used in their materials identification laboratory. One phosgene user returned a survey and reported that they generate and react phosgene in a closed system, where phosgene is consumed by the reaction. However, they also reported two small on-site fugitive releases of phosgene from their closed system.

The survey data demonstrate the different interpretations of chemical "use" that exist within the industrial community. This survey found that "using" a chemical doesn't necessarily imply that it undergoes a chemical reaction or that the chemical is actually

handled by employees beyond moving chemical containers around in a warehouse. This survey also demonstrated that their were potential occupational exposures to these HPV chemicals in certain situations.

Conclusions

The HPVIS system was useful in allowing us to gain information that became part of a prioritization scheme to address chemical hygiene and use. The details provided in the HPVIS data could be further complimented by accurate interpretive summaries of the data in the HPVIS, especially for those potential users of the HPVIS that may be less familiar with chemical regulations and toxicology.

References

Lefkowitz D, Blando J, Gerwel B, Wolf J, Valiante D, Bresnitz E. (2004) Development and Validation of a Mail Survey of Chemical Exposure: Final Report. Trenton, NJ: New Jersey Department of Health and Senior Services.