STUDY OF THE IMPACT OF HIGH AND LOW SODIUM STREETLIGHTS ON LAW ENFORCEMENT AND PUBLIC SAFETY

WILLIAM P. GLOEGE
DANA VAN GORDER
EDMUND LUKSUS

Planning and Evaluation Unit
Research and Development Division
San Jose Police Department

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BY THE

PLANNING AND EVALUATION UNIT OF THE

SAN JOSE POLICE DEPARTMENT

I. Introduction

In March of 1979, the City Council requested the San Jose Police Department, Research and Development Division, to determine what impact, if any, high and low pressure sodium streetlighting (Referred to below as HPS and LPS respectively) has on public safety. The City Council, in consideration of eventual conversion of all San Jose streetlighting to high or low pressure sodium fixtures to save electricity cost, wanted to insure no adverse problems were created for law enforcement.

In January, 1979, the National Institute of Law Enforcement and Criminal Justice published a study by Public Systems Evaluation, Inc., entitled "Phase I Evaluation of Streetlighting Projects."

The introduction quotes the 1967 Presidential Crime Commission:

> "There is no conclusive evidence that improved lighting will have a lasting or significant impact on crime rates....."

In 1973, the National Advisory Commission stated:

> "...these statistics cannot be interpreted as proof of the efficacy of lighting programs in reducing crime... additional scrutiny of these results is necessary."

The brief study undertaken by the San Jose Police Department has reached similar, tentative conclusions on its review of the impact of streetlighting on law enforcement and public safety, even though our study focused on high and low pressure sodium streetlighting. However, we believe this study does furnish useful guidance for the City.

II. The Study

The study was based specifically on the Council request:

1. Literature Search - Obtain and review literature on the public safety impact of high and low pressure lighting.

2. Survey other police departments in cities having either high or low pressure sodium lighting (or both) to inquire about the impact on law enforcement.

3. Survey San Jose Officers to determine their view of impacts on law enforcement based on experience to date (high and low pressure sodium lighting exists in test areas throughout the city).

III. Results

1. LITERATURE SURVEY

Few articles were found on the public safety impacts of high and/or low sodium lighting—even fewer compared with the public safety impacts of the two systems. Most of the literature reviews the effects on crime of lighting versus no lighting. However, what was found on HPS and LPS is included in our review.

Fifteen articles or letters were located which reviewed sodium street-lighting. This literature addressed one or the other type, both, undetermined type of sodium, or was a relevant general article on street-lighting and crime.

	LITERATURE CATEGORIES
SUBJECT	Number of Articles or Letters
LPS	8
HPS	2
LPS AND HPS	4
General	1
TOTAL	15

Since preponderance of articles were on LPS and these were generally positive, the literature survey produced more information supporting LPS lighting.

The chart below summarizes contents of each document reviewed:

SUMMARY OF LITERATURE SURVEY
ON THE IMPACT OF HIGH PRESSURE AND LOW PRESSURE
SODIUM STREETLIGHTING ON LAW ENFORCEMENT

NAMES OF SOURCES	COMMENTS OF ARTICLE ON LAW ENFORCEMENT IMPACT
Better Roads (8/76) (LPS)	New York Commissioner of Police recommends LPS, indicating officers have no problem with color identification. All streetlighting distorts colors; therefore, police vehicle headlights are used to identify color. No problem with traffic light or car taillight visibility. Roadway lines visible with LPS. LPS is glare free with backlighting which experts say desirable for safety and security.
J. of Illuminating Engineering Society (10/75) (LSP vs. HPS)	Data indicate roadway objects most visible in HPS. However, LPS provides better visual accuity (perception of small details) but this is not how motorist sees hazards.
Electrical Construction and Maintenance (11/76) (LPS)	Describes selection of LPS by Long Beach. Lamp failure of HPS and brightness/glare was a problem because basic mercury fixtures were used for light source. Police Department noted more see-through security with LPS at shopping centers due to soft distribution of light. 85% of homeowner respondents approved LPS. Driving not affected by LPS. LPS penetrates fog and eliminates glare in rain.
Lighting Design and Application (11/77) (HPS)	In Washington, D.C., during 24 month period following installation of HPS, nighttime crime dropped 50%. Street robberies dropped 65%, auto thefts 56%, housebreaking 44%, and vandalism 22%. Miami, Florida experienced 48.7% reduction in crime in HPS-lit area.
Electrical Review (1/73) (LPS)	One mile test strip in New York experienced fewer accidents after LPS installation. Two month survey of NYPD showed 36% decrease in accidents compared to year earlier. 85% of motorists surveyed favored LPS system. NY auto club endorsed lights due to better visibility and less glare.

NAMES OF SOURCES	COMMENTS OF ARTICLE ON LAW ENFORCEMENT IMPACT
Lighting Design and Application (12/74) (HPS and LPS)	Studies have found little evidence that one source is better than the other (HPS or LPS) from visibility standpoint. Not yet possible to make complete difinitive comparison of LPS and HPS. Color rendition better with HPS.
Lighting Design and Application (4/72) (LPS)	LPS provides light scatter to road shoulder and house side off roadway. Increases motorist's field of vision and feeling of driving security. LPS results in reduction of headlight glare. LPS enhanced noticeability of overhead directional signals lighted with fluorescent sources. All colors except yellow appeared distorted.
Letter from Captain Gusman, NYPD (3/72) (LPS)	Only negative aspect of LPS is poor color rendition. Minimal impact on law enforcement compared economic advantages. Increase of light in off-road adjacent areas a positive crime prevention measure. Accident reduction has been experienced in NY. Substantial savings in personal injury and property damage will be realized. Capt. Gusman recommends approval of LPS from law enforcement and accident prevention standpoint. Letter also contains comments of commanding motorcycle officer of a district who states he personally favors LPS and has no problems due to color rendition.
Letter from Lieutenant Brizzolara Long Beach PD (1/78)(LPS)	As officer in charge of Crime Prevention Unit feels LPS has many positive aspects. Only negative aspect from peace officer standpoint is color distortion; however, improved crime statistics in lighted areas coupled with efficiency of LPS outweigh color distortion. (Despite this letter, a call to Officer Rhodes, LAPD, indicates officers would prefer HPS.)
Letter from Carmen Gendusa, Assistant Traffic Engineer, Norwalk, CA (2/79) (LPS vs. HPS)	Norwalk had favorable experience with LPS compared to HPS. Less glare, more uniform light, better depth perception, no halo in moist air, no attraction for insects attributed to LPS. Author feels streetlighting is to provide visibility for vehicles and pedestrians to deter crime and provide sense of security, not to enhance landscape.

NAMES OF SOURCES	COMMENTS OF ARTICLE OF LAW ENFORCEMENT IMPACT
Letter from David N. Valkenaar Cambell Public Works Campbell PD (7/78) (LPS)	Campbell Police Department favored LPS at test location. As a result of test, 33 additional LPS lights installed in 1976 and 38 in 1977. Positive responses received; no negative responses.
Survey conducted by Market Facts of Canada, Ltd. (10/70) (LPS)	Approximately 3/4 of the respondents favored the LPS streetlighting. Superior to other lighting in conditions of dark, or rain, and in general.
University of Michigan LEAA Grant #73-NI-99-0046 (Sodium)	Study concludes improvements in street-lighting, deter crimes against persons but not necessarily against property. No specific results comparing HPS to LPS.
Atlanta Traffic Engineering Department Grant #72-DF-04-0076 (11/74) (HPS)	Installation of HPS found no evidence of crime diminution, although, small increase in nighttime burglaries experienced in target area.
Harrisburg PD Grant #SC-74-C-B1-6-239-S (74) (HPS)	Study found HPS made residents feel safer. Business owners and police foot patrol prefer sodium vapor lamps. No impact on crime could be supported from data.

2. SURVEY OF OTHER POLICE DEPARTMENTS

While information gathered from this aspect of the study is useful, locating the most knowledgeable and appropriate law enforcement and Public Works individual for comment was time consuming and not always successful. Some respondents had few comments on public safety impacts, but preferred instead to address political or aesthetic aspects of sodium lighting. Readers are cautioned that opinions are those of one or two officials. Also, it was not always possible to obtain a clear differentiation in responses between high and low pressure.

The results of this survey of nine California cities and three cities outside the State of California are summarized below (see Appendix B for a tabulation of survey results and narrative information obtained in the interviews). Cities interviewed for their reactions to high and low pressure sodium streetlighting were: Oakland, Sunnyvale, Campbell, Burbank, Norwalk, Long Beach, Santa Maria, Redwood City Beverly Hills, Canton, Ohio, Columbus, Ohio, and Knoxville, Tennessee.

Several points should be remembered in studying the results of the survey. First, there was an attempt made to find an equal number of cities with high and low pressure lighting. It has been our experience that a larger number of cities with significant

installations of sodium pressure streetlighting have installed low pressure. This situation complicates comparisons. While the personnel contacted in each Police Department were requested to divorce their personal impressions of the lighting from the official position of the Department (if there is any such position) it is difficult to determine to what extent this actually happened. Third, the installations of lighting in all of the cities surveyed might be quite different given local conditions, engineering departments, the choice of wattage used, etc. In such an interview, cities are perhaps inclined to justify any decisions made regarding project decisions of this kind—thus, the likelihood that any of the respondents would be very critical of their streetlighting choice is quite small (with the notable exception of Oakland. In this case, the Police Department did not participate in the decision making process.) Finally, the length of experience of the City with its streetlighting seems to impact its reaction to both low pressure and high pressure sodium. Presumably after some experience with the light, and after adjusting to both its good and bad characteristics, feelings are somewhat neutralized.

The attitude toward both forms of lighting seems very favorable. Low pressure seems to have the greatest acceptance of those cities using it, with six respondents indicating positive effects, one negative and one not apparent. In contrast, two cities attribute positive results on law enforcement with high pressure, one negative and two not apparent.

The greatest issue separating proponents and opponents of low pressure sodium is that of color rendition. Opponents argue strongly that its impact on the ability to determine the color of cars and clothing is significant enough to make it a poor choice. Proponents argue that this problem may be overcomed using various methods, and that over time an officer learns to identify colors in the light.

In the survey, two cities responded that low pressure has a positive effect and three, a negative effect on color rendition. It is interesting to note, however, that four cities indicated a negative effect on color rendition with high pressure, and no cities indicated a positive effect.

In asking the cities which form of lighting was preferred, three indicated low pressure, two high pressure and four no preference. On this question, low pressure does not hold up as well as on other questions. Based on the positive reaction to it on other questions, one might expect a greater number of cities to indicate its desirability.

Overall then, reviewing the results of the survey and narrative extracts which also follow, one finds acceptance of both kinds of lighting. Admittedly, the relative size of the samples affects this conclusion.

3. SURVEY OF SAN JOSE OFFICERS

San Jose patrol officers working evening hours were surveyed concerning their opinion of the impact of HPS and LPS on law enforcement. Eighty-six (86) police officers participated in the survey. The reader should remember that actual San Jose law enforcement experience with sodium light is limited, in that, with only test areas of the lighting, few

public safety situations have been directly influenced. Only with more lengthy experience will the effects of sodium lighting on public safety (if any) become known. For a complete tabulation of the responses of the 86 SJPD personnel, see Appendix C. Below, key findings from the survey are presented:

Sixty-six of the 86 respondents commented on whether they had noticed a difference in effects of HPS vs. LPS.

YES	50
NO	10
DON'T KNOW	6

Survey respondents were asked about the effects of HPS and LPS on law enforcement. Preestablished responses included distinguising color, visibility, crime prevention and other variables.

TOTAL NUMBER OF RESPONSES ON POSITIVE AND NEGATIVE EFFECTS OF HPS AND LPS LIGHTING (N of Respondents = 86)*

	Positive Effect Responses	Negative Effect Responses	No Effect	TOTAL RESPONSES
HIGH PRESSURE SODIUM (HPS)	185	121	110	416
LOW PRESSURE SODIUM (LPS)	99	249	61	409

The table above shows that HPS received twice the number of positive comments compared to LPS, and half the negative comments received by LPS.

Twenty-two respondents said they had only one type of lighting in their beat (HPS-9; LPS-13), and the remainder of the respondents (64) presumably had both types.

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* Each respondent provided several responses.

Asked what type of lighting they would recommend in their beat, 57 respondents answered:

HPS	17
LPS	6
MERCURY VAPOR	22
NO PREFERENCE	6
DON'T KNOW	6

Finally, 57 respondents gave the following responses regarding which light source was most suitable for law enforcement and public safety:

HPS	27
LPS	7
NO DIFFERENCE	12
NEITHER	11

As can be seen from the above results, HPS is "favored" by this group of 86 San Jose Police Officers. Further, they tie their responses to law enforcement and public safety issues in both forced-choice and open-ended responses. (See the complete data tabulation in Appendix C for open-ended responses.)

IV. Conclusion

While SJPD officers tended to "favor" HPS, results of the survey of other cities and the literature tended to support LPS. Considering all sources of information reviewed, the following conclusions can be drawn:

1. Both high and low pressure sodium streetlights aid law enforcement because, assuming adequate wattage, they increase and/or disburse light.

2. While San Jose officers state that LPS would make their job more difficult, they do not state LPS would create a hazard. Furthermore, this finding needs to be weighed against positive aspects of LPS revealed in the literature and the survey of other cities.

In summary, evidence we have reviewed indicates that neither HPS nor LPS have serious negative impacts on law enforcement.

Literature Survey of Public Safety Reports of Sodium Vapor Streetlighting

Appendix A

LITERATURE SURVEY

On the following pages are summaries (usually by exerpt) of some written communications on the subject of sodium vapor street lighting.

MAGAZINE ARTICLE

PUBLICATION: Better Roads

AUTHOR: Anon.

TITLE: "Low Pressure Sodium Lighting for Highways and Streets"

DATE: August, 1976, pp 30-31

The article lists a number of advantages to the L.P.S. system

"....First, its uniform, even monochromatic characteristic produces a better "modeling" of any illuminated surface. That is, the eye perceives the lighted object in three dimensions; depth perception is enhanced.

'Second, light of varying wavelengths tends to "scatter" producing haze or halo effect when passing through moisture-laden air.

'Because LPS light is primarily one wavelength, there is less scattering in fog and rain conditions-- again achieving better visibility.

'The third advantage is the close correspondence of the sodium wavelength with human eye response. The human eye has a peak response-- that is, it sees best-- at 560 nanometers, and this is advantageously close to the output of the LPS lamp at 589 nanometers.

'A fourth advantage is that invisible ultraviolet radiation, which can be harmful to the human eye in continuous doses, is entirely lacking from LPS light.

'While people see better in amber light, insects don't see amber light at all. They are completely indifferent to LPS lamps. As a result, there are no annoying insect gatherings around residential street lamps, therefore no accumulation of insect bodies to clean out or to decrease from lighting efficiency. This saves on maintenance.

'...New York City's West Side Highway has been converted to LPS. Its use is recommended by New York Commissioner of Police, who points out that law enforcement officers do not consider amber light a problem at all in identifying the color of a vehicle. The fact is that they do not depend on any form of streetlighting for color identification because of distortion factors experienced with all methods. Instead, they rely on their police vehicle headlights."

"There is no visibility problem whatever with traffic lights or car taillights under LPS. They generate their own true red or green light which is not affected by LPS.

"Roadway lines, whether white or yellow, are also readily visible by LPS light. Yellow/black signs show better than in white light. Red/white street signs show yellow on dark background and are perfectly legible. In any event, such signs are usually picked out only by the tungsten headlights of the car."

Better Roads (cont.)

"Overhead directional signs are often illuminated with separate sources. They tend to be more noticeable under LPS than in a mercury vapor environment because of reduced distracting glare."

"Another advantage of LPS lighting on highways is its glare-free backlighting pattern. Experts agree some backlighting or environmental lighting is desirable for safety, security, and to avoid 'tunnel of light' monotony."

MAGAZINE ARTICLE

Journal of the Illuminating Engineering Society
"Roadway Visibility As a Function of Light Source Color"
J. A. Buck, T. K. McGowan, and J. F. McNellis
with responses by W. N. Edman and R. A. Lewis

Journal of the Illuminating Engineering Society

October, 1975, pp 20-25

"Since 1943, the subject [the relative merits of lighting with high and low pressure lighting] has been examined a number of times with mixed results. Some European researchers have concluded that the monochromatic characteristics of low pressure sodium are best, while a North American study indicated that there is little difference among incandescent, mercury and sodium sources."

"While the visibility differences are very small, the data of this experiment indicate that roadway objects are most visible in light from high pressure sodium lamps. Low pressure sodium and deluxe white mercury sources ranked second and third respectively."

"There is no doubt that monochromatic illumination [low pressure] provides better visual acuity (perception of small details), but this is not how the motorist initially sees a hazard. First, the gross characteristics of the object are seen by contrast, then, by visual acuity, details become visible. Another consideration is that under monochromatic illumination, color contrast is entirely obliterated, thus further complicating the detection of colored objects. Headlights do not always alleviate this problem since, with headlights, overall visibility can be reduced even though color contrast is enhanced."

W. N. Edman

"The actual advantage of high pressure sodium over low pressure sodium is also questionable. While the measurements for the three objects selected [for the study] showed a small advantage for high pressure sodium, it did not seem that the authors meant to imply any significant superiority over the low pressure sodium for roadway lighting visibility."

R. A. Lewis

The differences in the visibility of the three test objects are indeed small. Perhaps when further studies are carried out, and other significant factors are incorporated, more meaningful differences will result. In this respect, the influence of glare cannot be overlooked.

"The work of deBoer has shown that recovery time under monochromatic light is significantly reduced."

"We question the significance of the detection of the true color of an object and, therefore, the objection to monochromatic light, in this respect, if monochromatic light in fact enhances visual acuity."

MAGAZINE ARTICLE

PUBLICATION: ELECTRICAL CONSTRUCTION AND MAINTENANCE

AUTHOR: Joseph A. Spinelli

TITLE: "Low Pressure-Sodium Lamps Solve Street-lighting Problems"

DATE: November, 1976

This article describes the process by which the City of Long Beach arrived at its decision to choose low pressure sodium systems over high pressure.

"....We originally had become interested in high-pressure-sodium (HPS) lamps in 1970 when we were designing the Pacfic Coast Highway lighting district. Our engineering department conducted a study of the 400-watt HPS and the 700-watt mercury-vapor lamps along a 10-mile stretch of this highway. The HPS lamp considered for this application had an efficiency of 117 lumens per watt and a life of 20,000 hours. The mercury-lamp, with an efficiency of 50 lumens per watt, had an average life of 24,000 hours.

"The economics in favor of a change to HPS lamps looked favorable; however, the system proved unreliable because of early lamp failure and ballast problems. Furthermore, we discovered that the brightness/glare problem was intensified because the basic mercury fixture concept was being utilized for a light source with an efficiency more than twice the design acceptance currently being used by our standards.

"In 1973, we reopened the case on sodium lighting, this time with a look at low-pressure-sodium lamps...low-pressure-sodium lamps are the most efficient lamps commercially available for high-intensity-discharge street-lighting, emitting up to 183 lumens per watt. The amber-colored light,... its frequency is very near the most sensitive point of response (589 namometers) of the human eye...."

"....The police department noted that a more-thorough security surveillance of the shopping area was possible because of the soft, even distribution of the light...."

"In the residential test, we anticipated negative reactions from homeowners because of the color of the light and the significant amount of backlighting emitted by the lamps."

"....85% of the respondents approved the appearance of the low-pressure-sodium lamps (see chart)-- that they actually found the color of the light soft and pleasing."

"We have found that, although LPS lamps change the natural color renditions, driving is not affected. While a red stop sign will not appear red in low pressure sodium light, the redness becomes apparent immediately when vehicle headlights strike the sign."

"Light from LPS lamps appears to penetrate fog effectively and virtually eliminates glare problems in the rain. This differs sharply from white light, which reflects off moisture particles and reduces visibility.

-Mr. Spinelli has retired. Ron Hook of the Long Beach Public Works Department verified the points made in the article.

MAGAZINE ARTICLE

PUBLICATION: Lighting Design and Application

AUTHOR: Craig W. LeVere

TITLE: Streetlighting as a Crime Deterrent

"The Washington, D.C. project resulted in some significant reductions in crime, as well as some welcome energy savings. In the 24-month period following the installation of high pressure sodium lights, overall nighttime crime was reduced 50 percent. Street robberies decreased 65 percent; auto thefts, 56 percent; housebreaking incidents, 44 percent; and vandalism 22 percent."

"Miami, Florida, completed a streetlighting program in 1972, in which ten blocks of the downtown area were relighted with high pressure sodium units. The result was a 48.7 percent reduction in crimes occurring in the relighted area."

MAGAZINE ARTICLE

PUBLICATION: Electrical Review (British)

AUTHOR: Anon.

TITLE: New York Motorists Favour Low Pressure Sodium Lights

DATE: January, 1973

"An experiment in high-intensity lighting on the Henry Hudson Parkway has resulted in fewer accidents along a one mile strip of West Side Drive in New York City.

"A two-month survey by the New York Police Department showed a 36 percent decrease in accidents compared with the same two month period a year earlier.

"The City Public Works Commissioner, Mr. Alfred C. Maevis, said that the installation of experimental low pressure sodium lighting began in December, 1971. Since that time, 85 percent of motorists responding to a questionnaire asking for comments on the amber colored lights said they definitely favoured the new lights.

"The Automobile Club of New York has also endorsed the lights, finding that they improve visibility and reduce glare."

MAGAZINE ARTICLE

PUBLICATION: Lighting Design and Application

AUTHOR: Terry K. McGowan*

TITLE: HPS and LPS - A Primer

DATE: December, 1974

" A low mounting height is advantageous for the LPS system because of the lamp's diffuse light-emitting characteristics. This lack of light control is also quantitatively apparent from an examination of photometric data. Almost 40 percent of the light emitted by the lamp is directed toward the house side, or away from the traffic lanes, compared to about 20 percent for HPS luminaires."

"...but studies have found very little evidence that any one source is better than another from a visibility standpoint.

"Unfortunately, because of these gaps [in comparative information concerning the systems] it is not yet possible to make a complete, definitive comparison of the various sources and systems. As always, good engineering judgment along with experience, is still required.

"Color [of the HPS lamp] is much improved over the LPS sources, because light is emitted in the red, orange, green, and blue portions of the spectrum in addition to the yellow. The colors of all objects can be determined, but colors are somewhat distorted toward the red (warm) end of the spectrum."

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*The author is a lighting specialist in the Lamp Business Division of General Electric Co., a producer of high pressure sodium lamps.

MAGAZINE ARTICLE

PUBLICATION: Journal of the Illuminating Engineering Society

AUTHOR: Glenn A. Fry

TITLE: Blur of the Retinal Image of an Object Illuminated by Low Pressure and High Pressure Sodium Lamps

DATE: April, 1978, pp 158-164

"As is to be expected, the heterochromatic high pressure source has a greater depth of focus, but once the eye is in good focus, monochromatic [low pressure] light gives the sharper image."

"If we need more light, we can produce it by mounting more luminaires above the highway. The question is whether it costs more to provide the same level of retinal illuminance using low pressure as opposed to high pressure sodium sources. We have to produce more lumens to achieve the same level of retinal illuminance with high pressure sources as compared with low pressure sources because of the difference in pupil size."

"Claims have also been made that heterochromatic light provides a more pleasant and otherwise psychologically desirable environment in which to operate."

"In regard to discomfort glare, the fact remains that the pupil will receive more stimulation from high pressure sodium light because rods in the periphery are more intensely stimulated. If the same amount of photopic retinal illuminance is covering the fovea, the pupil constriction will be more pronounced for high pressure sodium light."

"The advantages of color contrast are lost when monochromatic light sources are used. Theoretically, one could design a road sign that is more readable with monochromatic light than with heterochromatic light because of an increase in brightness contrast, and this might be true even in some combinations of natural objects. But the overall advantage for the effect of color and brightness contrast on the visibility of objects would undoubtedly be in favor of heterochromatic sources. The use of color coding with reflected light would be out of the question with monochromatic light."

MAGAZINE ARTICLE

PUBLICATION: Lighting Design and Application

AUTHOR: R. Stark and H. Cossyphas

TITLE: A Second Look at Low-Pressure Sodium

DATE: April, 1972

"High light flux densities were observed on the shoulder and house side of the expressway, eliminating transverse transitional adaptation difficuties. This increase in the motorists' field of view is believed to enhance a feeling of security by alleviating the fear of seclusion, usually suggested by lighting systems that do not illuminate areas adjacent to the roadway or which over-emphasize optical guidance."

"A reduction in headlight glare was also achieved with this installation. The increase in ambient illumination levels resulted in glare reduction from the headlights."

"It was observed that the yellow environment provided by the low-pressure sodium installation enhanced the noticeability of overhead directional signs lighted with fluorescent sources. The color contrast between the sign and environment served as an attention gaining technique. The photometric characteristics of the illuminated signs were not otherwise affected. The visibility of the unlighted roadway signs appeared to be somewhat improved by the low-pressure sodium light due to the increase of light flux in the house side of the road. The lane separating delineation stripes were enhanced under this system because of the improved color rendering of the pavement and stripes themselves.

"In the area of true (daylight) color rendering, the low pressure sodium installation appeared inferior to the mercury system as anticipated. Low pressure sodium emits monochromatic radiation is emitted in the visible spectrum. Consequently all colors - except yellow - appear distorted."

LETTER
(Memorandum)

FROM: Capt. Kenneth Gusman, New York P.D. Investigation Squad

TO: Commanding Officer of the Traffic Division

SUBJECT: Evaluation of New Type of Lighting Experiment on Henry Hudson Parkway Between 158th and 182nd Streets

DATE: March 6, 1972

"On the basis of the foregoing data from recognized authorities in this field, the only negative aspect of this installation is the poor color rendition of the low pressure sodium lamp but its effect, if any on law enforcement, is minimal compared to the apparent economic advantages gained. The marked increase of light off the road adjacent to the parkway will be a positive preventive measure to reduce criminal violations of law against parked/sleeping motorists. Finally, the reduction of accidents for the first two months is comparable to the Toronto accident reduction. If this accident pattern continues, this type of installation on an extensive basis will produce substantial savings in the form of property and personal injuries. Therefore recommended APPROVAL by this department from a law enforcement and accident prevention perspective."

"Mr. Andrew Edson, Education Director of the Street and Highway Safety Lighting Bureau...declared that from a safety viewpoint, the amount of light shed by the LPS lamps affords more vision to the driver of a vehicle which in turn cuts down on traffic accidents."

"Conferred with the Commanding Officer, Motorcycle District, who stated that his personnel...in the vicinity of the installation have commented favorably upon its effects and have had no problems caused by the poor color rendition of the vehicles in that area."

LETTER
(Memorandum)

FROM: Lt. E. J. Brizzolara, Long Beach Police Department

TO: Joseph Spinelli, Special Projects, City of Long Beach

SUBJECT: A newspaper article

DATE: January 7, 1978

The memorandum is in rebuttal to a newspaper article that emphasized LPS's inability to accurately render colors.

"....As the officer in charge of the Crime Prevention Unit, I feel that the aforementioned form of lighting has many positive aspects. The one and only negative aspect to this form of lighting from a peace officer's standpoint is some distortion of color. However, as the crime statistics for areas illuminated by this form of lighting indicate, the added illumination coupled with the efficiency of low sodium lighting far outweigh the negative aspect of color distortion."

-A call to Officer Larry Roads of the Long Beach P.D. reveals that the Long Beach police officers would prefer to have the HPS.

LETTER

FROM: Carmen Gendusa, Assistant Traffic Engineer, City of Norwalk

TO: Prof. Sandra Faber

SUBJECT: Comparison of LPS to HPS

DATE: February 2, 1979

Ms. Gendusa very emphatically states that the City of Norwalk has had very favorable experiences with the low pressure sodium lighting as compared to high pressure. She specifically mentions the following: less glare, more uniform lighting, better depth perception, no halo effect in moist air, and no attraction for insects. She specifically mentions a detailed, side-by-side test of low pressure and high pressure systems. Her closing paragraph contains the following statement:

> ".....streetlighting is to provide night time visibility for vehicles and pedestrians, to deter crime to provide a feeling of security, etc. It's not put there to enhance the landscape. If you want good color rendition, don't use LPS. If you want the most economical lighting system, one that saves dollars and energy, use LPS. There comes a point where you must decide how much true color rendition is worth."

-A phone call to Ms. Gendusa verifies that the letter accurately states her opinions, and that (if anything) the intervening year and a half has strenghtened them.

LETTER

FROM: David N. Valkenaar, Campbell Public Works Department

TO: Prof. Sandra M. Faber

SUBJECT: LPS Lighting in Campbell

DATE: July 27, 1978

"On August 15, 1975, the six-400 watt and one-250 watt vapor lights at the intersection of Campbell Avenue and Winchester Boulevard were replaced with four, 180 watt low pressure sodium lights. Public reaction and response was solicited via the San Jose Mercury News and the Campbell Press. Our Police Department favored the lights.

"As a result of that test installation, we installed 33 additional LPS lights in 1976 and another 38 LPS lights in 1977. We have received a few unsolicited positive responses (citing better overall light and softer light) and no negative responses."

-A phone call to Mr. Valkenaar verifies the comments made in the letter.

SURVEY

Conducted by Market Facts of Canada, Ltd. for
Philips Electronics Industries, October, 1970

This survey tested the reactions of "professional"* drivers and private citizens to the installation of LPS lighting on a one-mile stretch of the Spadina/Allen Expressway in Toronto, Canada.

"In your experience of driving after dark on the expressway, would you say visibility in clear weather is: better with the usual lights than the yellow, better with the yellow lights than the usual, (or) about the same?"

	%	
	Private	Professional
Sodium	73	67
Normal	10	20
No difference	17	13

"In rainy or misty weather, would you say the visibility is: better with the usual lights than the yellow, better with the yellow lights than the usual, (or) about the same?"

	%	
	Private	Professional
Sodium	76	73
Normal	4	11
No difference	16	12
No answer	3	3

"Are road signs easier to read with the usual lights, yellow lights, or is there no difference?"**

	%	
	Private	Professional
Sodium	32	28
Normal	9	17
No difference	55	49
No answer	4	5

"Generally speaking, which do you think is the safer of the two types of highway lighting to drive in?"

	%	
	Private	Professional
Sodium	75	68
Normal	13	15
No difference	11	17
No answer	1	-

*No definition of "professional drivers" is given.

**The survey team admitted that there was some misunderstanding of this question. Respondents confused electric road lights with roadside signs intended by the question.

LITERATURE SURVEY

by

NCJRS Reference Services

DATED: April 27, 1979

TOPIC: Sodium Lighting

The abstracts forwarded by the reference service were four in number, none of which compared high pressure sodium sources to low pressure. The abstracts are summarized as follows:

1. An article from the June, 1974, issue of Police Chief, titled "Bright Answer to the Crime and Energy Question." The article concludes that sodium vapor are most efficient.

2. A research study sponsored by the University of Michigan under LEAA funding, Grant #73-NI-99-0046, published in 1974 and titled "Impact of Streetlighting on Crime, authored by R. Wright and P. Pelletier. The study concludes that improvements in streetlighting programs can deter crimes against persons but need not necessarily deter crimes against property. Although the study compared some type of sodium vapor system against other systems, the abstract mentions no results specific to sodium. HPS

3. The evaluation report on work done under Grant #72-DF-04-0076 by the Atlanta Traffic Engineering Department. The report is titled "Atlanta- Streetlight Project- Final Evaluation Report, December, 1973 - November, 1974," published in 1974. The Traffic Engineering Department installed high pressure sodium lamps and found no evidence of target crime dimunition due to the illumination, although there was some indication of small increase in nighttime burglaries in the target area.

4. The evaluation report on work done under Grant #SC-74-C-B1-6-239-S by the Harrisburg Police Department. The report is titled "Harrisburg Police Department - High Intensity Streetlighting Program - Final Evaluation Report," published in 1976. The report indicates that residents feel safer with HPS lighting in place of an older system, and that business owners and police foot patrol also prefer the sodium vapor lamps. However, good effects on crime rates could not be supported with data.

Results of Survey of Cities Having High Pressure and/or Low Pressure Sodium Vapor Streetlight

Appendix B

INTERVIEWS WITH POLICE PERSONNEL OF ELEVEN CITIES ON THE SUBJECT OF SODIUM VAPOR LIGHTING SYSTEMS

INTRODUCTION

As part of the study of sodium vapor lighting, police personnel were interviewed from nine California cities and three cities out of state. The California cities were: Oakland, Sunnyvale, Campbell, Burbank, Norwalk, Long Beach, Santa Maria, Redwood City, and Beverly Hills. The three cities out of state were: Canton, Ohio; Columbus, Ohio; and Knoxville, Tennessee.

There is no uniformity of police opinions, city-to-city, which seems to indicate that the differences between cities are stronger influences on police opinion than are any affects upon law enforcement inherent in the natures of either low pressure sodium vapor (LPS) or high pressure sodium vapor (HPS) lighting systems. For example, a city is free to choose differing wattage sodium vapor lamps depending on how highly they prize cost savings relative to illumination. City administrations also differ in the finesse with which they introduce changes to the Police Department and to the citizenry. Spacing and/or height of luminaires may vary from city-to-city. The type of development, whether predominantly residential or commercial may also affect how a certain combination of lighting factors are viewed. Because of the many differences that can exist between cities, each interview is contained in a separate section.

Although the purpose of the interviews was to elicit law enforcement-oriented comments, there were various reasons for which it would occasionally be either necessary or convenient to also contact the city's Public Works Department. This would occur when a law enforcement official was difficult to contact directly (as with Norwalk, which contracts with the L.A. Sheriff's Department), when it was uncertain whether an officer understood the difference

between LPS and HPS, when no police person was available for comment at the moment,etc. When this occurred, mention is made to it in the narrative.

OAKLAND

Sergeant Nicolini of the Oakland Police Department considers the HPS to be inferior to mercury vapor. He stated that, although it was the Electrical Department that made the decision to change lighting systems, the police are the ones who receive the complaints. He attributes increased traffic accident rates to the lighting, saying that the contrast between dark and light zones (HPS can be made very focused) makes it difficult to see pedestrians or moving vehicles when they make a sudden transition out of shadows and into the light. He says that the lack of back lighting makes it difficult to see loiterers and otherwise suspicious persons who can easily retreat into shadows and yet be near enough to accost someone on the sidewalk. Sergeant Nicolini also said that the light in not sufficiently illuminating even in the bright patches.

To verify that Oakland has given priority to highly focused street lighting, Mr. Dickerson of the Electrical Department was contacted. He said that HPS was chosen largely for the high percent of its illumination that is focused on the roadway.

SUNNYVALE

To learn about a consultant's report commissioned by the City of Sunnyvale, under State funding, Mr. Belluomini of the Traffic Division was contacted. He prefered to defer discussion of details pending the acceptance of the final

report by the State. The one detail that he did express was a fear that the amber LPS light could interfere with motorists' perceptions of the the amber caution light of the city's traffic signals. He stated that a traffic fatality had occurred somewhere in Southern California due to this confusion (interviews with city personnel of Southern California cities elicited that the accident referred to may have been one that occurred in Burbank, and which will be mentioned in the section on that city). Mr. Belluomini stated that Sunnyvale's choice of HPS over LPS was largely due to Sunnyvale's being a low crime city for which law enforcement aspects need not be emphasized. This apparently meant that LPS's backlighting was not considered an advantage to offset the brightness that HPS is capable of focusing on the roadway underneath.

Officer Burnham of Sunnyvale's Public Safety Department had high praise for the brightness of both LPS and HPS compared to the older mercury vapor lighting. Both have sufficient backlighting. Both have an advantage of not brightly reflecting off of an officer's highly polished belt buckle, badge, etc. Both make it possible to tell at a distance whether a suspect is drawing a weapon. Both distort color, which is minor compared to other advantages-- although initially he and other officers had been against the new lighting because of the color issue. Now, however, he is emphatic in saying that a city should not hesitate in using either one. Both have a small, but positive crime prevention effect. Criminals have fewer dark places from which to accost pedestrians or to gain illegal entry. He agrees with Mr. Belluomini that there is a problem with the amber traffic signal in the presence of LPS, but that this may be in part due to placement of the traffic lights. He has a slight preference for HPS, but says that if he were in another city with differing types of development his preference might differ.

CAMPBELL

Captain Butler of the Campbell P.D. believes there is a very small and positive crime prevention effect to LPS. The color distortion is the only negative factor, and that is marginal because HPS also distorts color. He has good things to say about both HPS and LPS, although marginally favoring the latter. There have been some complaints about HPS. A call to David Valenaar of the Campbell Public Works Department verified that there have been some complaints about HPS from residential areas in which very few have been installed. HPS' glare appears to bother some residents who wish to maintain their neighborhoods with as rural an atmosphere as possible. Campbell tends to install LPS because it is inexpensive, both for installation and operating costs, and law enforcement is not a major consideration.

BURBANK

Captain Hein of the Burbank P.D. states that LPS received thorough small scale tests in warehousing, industrial areas, and shopping centers with emphasis on ability to broadcast high illumination over parking lots and building entrances LPS performed very well, and has also gained favorable responses in residential areas. Tests are underway, however, to decide whether it would be better to place HPS along certain major thoroughfares. There had been a fatal accident in which a motorist appears to have successfully pressed his claim that he was confused by the LPS to the extent of not seeing the amber traffic light. Thorough testing indicated that this may have been the case at this one intersection due to the placement of lights, but is not likely a problem at other intersections along the same thoroughfare. Captain Hein has not perceived an effect on law enforcement one way or the other.

Mr. Bullock of the Burbank Public Works Department stated that less than 5% of that city's streetlights were LPS. He believes that crime was displaced from manufacturing and commercial areas using LPS and toward darker areas. Residents bordering on commercial areas lighted with LPS express satisfaction with the broadly distributed light that spills over into their residential neighborhoods. The city has not yet decided whether to use LPS or HPS along thoroughfares, but there are no plans to use HPS in residential areas.

NORWALK

Norwalk does not have its own Police Department. The first contact was made with Carmen Gendusa of the Public Works Department, who is a well-known proponent of LPS over HPS. In response to reports that HPS did not perform to manufacturers' claims, his Department had performed extensive field tests of HPS compared to LPS and had come to the conclusion that, in order to achieve the same visibility on the roadway, higher wattage HPS needed to be used than was the case with LPS. The backlighting afforded by LPS seems to provide public safety officers and residents with greater security. Norwalk is approximately 30% into its streetlight conversion program.

Deputy Ron Hook of the L.A. Sheriff's Department, which polices Norwalk on contract with the city, states that LPS does have a moderately positive effect on crime prevention. He has no HPS reference with which to compare, but the backlighting makes LPS far more effective at lighting neighborhoods than mercury vapor lighting. This is evident from the air, backyards being surveillable. Also, the LPS light reflects very well from black asphalt so that it is possible to see great distances along an asphalt roadway.

LONG BEACH

Officer Larry Rhoads of the Long Beach P.D. indicates that the Department's officers would opt for HPS if they had the choice. He also states that citizens do not like the LPS, which comprises more than 75% of the city's lighting; and cites a referendum on the subject as proof of this assertion. Yet, when asked to rate LPS relative to law enforcement, he failed to give it positive marks in only two categories: (1) his perception of a negative impact due to color distortion and 2) his perception of no difference relative to traffic conditions. He gave positive marks to LPS for general visfbility, visibility of persons and property, and on-road and off-road visibilities.

SANTA MARIA

Carmen Gendusa of Norwalk had mentioned Santa Maria as another city that had extensively studied LPS and HPS before choosing LPS. Ray Emberton of Santa Maria's Public Works Department says that they had originally decided on HPS but that subsequent side-by-side testing with light meters had indicated that LPS would be a better choice. In his opinion, public relations shortcomings have been a problem source when cities' have encountered resistence to lighting changes. His Department made it a point to apprise the public and all city departments of their choice, and particularly to take their City Council persons on tours of affected neighborhoods during the initial testing phase. The LPS performs exceptionally well during fog and rain, suffering virtually no dimunition of general visibility. He rejects any criticism based on color distortion, saying that such critics should

logically prohibit color-blind persons from driving. Economy of installation and operating costs were the city's major criteria for choosing LPS over HPS, law enforcement largely entering in through the process of apprising all City departments of the progress of the lighting program.

Sergeant Farrel of the Santa Maria Police Department states that LPS has been very good for traffic conditions and for crime prevention. Colors do change, but he has heard no complaints and he thinks this is because one can see so much more with LPS that color perception is minor in comparison. There are far fewer shadows when LPS is used. He volunteered reference to a neighborhood that had had problem with recurring traffic accidents, but which has presented no problem since installation of the new lights.

REDWOOD CITY

Lt. Laberge of the Redwood City Police Department says that, after 9-10 months of having LPS on a stretch in front of the Police Building, he no longer gives the new lights a thought. At first he did not like them, but has gotten used to LPS. Positive features are backlighting with virtual elimination of shadows, a particularly stringent test of this being provided by a redwood tree across the street which now casts little shadow at night in contradiction to the environment under mercury vapor. Initially color rendition had been a problem, but officers have learned to recognize most colors as they appear under LPS. Traffic conditions appear to have improved on a stretch of road that had frequently been the scene of overturned vehicles. That stretch is banked the wrong way, but has featured no accident since installation of the new lights. As evidence of habits and first impressions persisting, Lt. Laberge states that he still has some residual negative feelings about LPS although he has come to accept and approve of it.

The strech of road in front of the Police Department is the only notable use of sodium vapor lighting in Redwood City aside from a stretch of road leading to Marine World, which is HPS and which he has not considered considered from a law enforcement standpoint.

BEVERLY HILLS

Sergeant Campbell of the Beverly Hills P.D. was surprised that anyone would inquire about LPS (of which Beverly hills has some, largely in residential areas). He has perceived no difference one way or another. He asked an officer who was near at hand, and reported that this officer also considered the LPS neither a positive nor a negative influence. Color rendition at night is immaterial.

KNOXVILLE, TENESSEE

The Day Sergeant of the Knoxville P.D. was very enthusiastic about LPS. The range of night vision is so much greater, particularly during traffic enforcement for athletic events at the University of Tennessee. Motorists and traffic control officers can see one another much further away than with mercury vapor. Also, as an added bonus, the orange vests worn by officers are very much more visible for traffic control. Regarding color rendition, he says that it may have been a problem at first, but that one learns what the colors look like under the amber light. Besides, under mercury vapor, so much was black that is now visible that he must give LPS a positive evaluation on the subject of color rendition.

COLUMBUS, OHIO

Officer Morris of Columbus' Patrol Division was enthusiastic in support of LPS, volunteering information with no need of prompting. He did not consider color rendition a problem because so much more was visible than before, and with more detail. On patrol he feels much more secure having a very wide field of vision, and believes that the typical citizen must feel the same way. He has not heard any complaints from other officers during the year that the LPS has been in place. Relatively few lights have been replaced thus far, likely fewer than 5%.

CANTON, OHIO

Police Chief Mason of Canton, Ohio could make no judgement regarding law enforcement and the HPS that is present on a short stretch of expressway in Canton. He says that the HPS is so bright that one can locate that stretch of road miles away. There is no problem with HPS, except that with two types of lighting on the expressway it is disconcerting to pass from one type to another.

SUMMARY AND CONCLUSION

As stated in the introduction, the differences between cities are far greater than the differences that can be expected within the police department of a given city. This means that a statistical comparison is not possible except at great cost and effort. Some qualitative conclusions can be drawn, however, that can perhaps guide a city's activities when implementing a program of conversion to LPS, HPS, or a combination.

An important conclusion is that it may take many months before police officers become accustomed and accepting of a new lighting system, e.g., our respondents' comments concerning Sunnyvale and Redwood City. The respondents from Redwood City and Knoxville indicate that, with long familiarity, even problems of color rendition can be overcome as officers learn what various colors look like under the new light.

The most surprising result of this survey was to find the high degree of acceptance of LPS, whose lighting characteristics are much more different from those of mercury vapor than are those of HPS. Police officers, regardless of city, are very conscious of color and, although both sodium systems distort color, LPS does it more so than HPS. The only interview that ran counter to this was with Officer Rhoads of Long Beach who gave LPS good reports on all characteristics of nighttime vision except color rendition and then cited that color characteristic as being sufficient to make LPS unacceptable. A little deeper knowledge of the Long Beach situation may put this in perspective.

The City of Long Beach may have shown less than perfect tact when introducing LPS, as evidenced by a referendum that was then called and which only narrowly supported the new lighting system. According to Mr. Gendusa of Norwalk, that referendum came about because the affluent, and politically active residents of the Belmont Shores community had not been notified prior to the removal of their own expensive and decorative luminaires and their replacement with the more austere LPS luminaires. Some prior consultation with the residents may have tempered the reaction. On the face of it, a single issue such as lighting does not seem to be sufficient to cause such a stir if it is the only political issue, and if political "fence mending" has been practiced. Something similar may have occurred in the HPS City of Oakland. Sergeant Nicolini made it a point to mention that it had been the Lighting Deparmtent's decision

62981

CITY OF SAN JOSE, CALIFORNIA

201 W. MISSION STREET
TELEPHONE (408) 277-4000

P. O. BOX 270
95103

POLICE DEPARTMENT

October 24, 1979

National Criminal Justice
Reference Service
Law Enforcement Assistance
Administration
Department of Justice
Washington, D.C.

Dear Sirs,

In accordance with your request for studies and documents generated at the local level, we are hereby enclosing a copy of a "Study of the Impact of High and Low Sodium Streetlights on Law Enforcement and Public Safety." This study was produced in September, 1979.

We are enclosing two copies. We could furnish several more copies if required. Thank you.

Sincerely,

WILLIAM P. GLOEGE
Administrative Analyst III
Research & Development

WPG:ln

Enclosures

to install the HPS. Perhaps if the Police Department had been apprised of the need for lower cost sodium vapor lighting, acceptance might have been better. In both the case of Long Beach and Oakland, the sodium systems have been in place for more than a year; and, if the experiences of other cities are applicable, criticisms of the change should have dissipated and even changed to acceptance if the newness of the systems and the color changes were the only factors.

The major inference to be drawn from this survey seems to be that, given time, either HPS or LPS can be accepted by police-- even enthusiastically in some cases-- but that, if introduced in an impolitic manner, they may be capable of being a focus of resentment.

Tabulation of San Jose Police Officer Responses on Survey of Public Safety Reports of Sodium Vapor Streetlighting

Appendix C

86 RESPONSES

SJPD SURVEY OF PUBLIC SAFETY
IMPACT OF HIGH & LOW PRESSURE SODIUM STREET LIGHTING

DATE _____

OFFICER'S NAME _____

SHIFT _____

BEAT _____

The City Council has approved a large expenditure for sodium pressure street lighting, designed to significantly reduce lighting costs. The Council, concerned with the relative merits or problems of the various kinds of lighting, has requested a study of the public safety impact of high and low pressure sodium. Your judgement, based on field experience, is essential to this study by Research and Development. Thank you for cooperating. Please return this survey to your Sergeant on or before July 26.

As opposed to the older mercury vapor lighting which casts a blue light, high pressure sodium light is pinkish in color, and low pressure sodium lighting is deep amber. Mercury and high pressure sodium fixtures are similar in that both are rounded, but viewed from the street, high pressure fixtures are flat on the bottom while mercury has a protruding bulb. Low pressure fixtures are long and cylindrical in shape.

IF BOTH HIGH AND LOW PRESSURE SODIUM PRESSURE STREET LIGHTING ARE USED IN YOUR BEAT: (If only one kind is used in your beat, skip to Question 9.)

1. Have you noticed any difference between the effects of high and low pressure fixtures?

YES 50 NO 10 DON'T KNOW 6

2. In which of the following respects does HIGH pressure sodium lighting affect the performance of law enforcement duties? Is the impact positive or negative? Note your reasons below.

	AFFECTS POSITIVELY	AFFECTS NEGATIVELY	NO DIFFERENCE	DON'T KNOW
a. Distinguishing color	22	12	16	6
b. General visibility	28	16	11	2
c. On-road visibility	26	26	12	3
d. Off-road visibility	23	17	11	4
e. Property visibility	22	16	15	3

f. Visibility of persons	25	15	13	3
g. Crime prevention	18	9	16	13
h. Traffic conditions	21	10	16	8
	(185)	(121)	(110)	(42)

REASONS: Reduced visibility, reaction time. Hazardous in four weather. Reduces glare. Creates shadows, backlighting bad. Poor color rendition, objects blend together. Creates "night blindness." Easier to distinguish movement of cars, people.

3. Would you differentiate between the effects of HIGH pressure sodium lighting on law enforcement duties in commercial versus residential locations? How?

YES 13 NO 21 DON'T KNOW 24

HOW? Lighting better in commercial areas, can't see as well in commercial areas. More and better light in both areas, poor visibility. Easy on eyes to see surrounding areas.

4. In which of the following respects does LOW pressure sodium lighting affect performance of law enforcement duties? Is the impact positive or negative? Note your reasons below.

	AFFECTS POSITIVELY	AFFECTS NEGATIVELY	NO DIFFERENCE	DON'T KNOW
a. Distinguishing color	10	35	7	7
B. General visibility	17	32	5	6
c. On-road visibility	16	30	6	7
d. Off-road visibility	13	33	6	8
e. Property visibility	10	33	9	8
f. Visibility of persons	15	32	7	6
g. Crime prevention	9	27	8	16
h. Traffic conditions	9	27	13	11
	(99)	(249)	(61)	(69)

REASONS: Things seem too dark, can't make out details well. Defeats amber traffic signals, can see dark areas better, better backlighting, appears foggy, "pleasing orange glow," need to use spotlight to see into shadows, can distinguish people's features better, hard on eyes, less glare, distorts colors.

5. Would you differentiate between the effects of LOW pressure sodium lighting on law enforcement duties in commercial versus residential locations? How?

YES 15 NO 23 DON'T KNOW 21

HOW? Too dark for both. Commercial areas need more light, prefer LPS. Prefer bright light in both. Blends building color together. Can see better in business areas. Not enough light on businesses. No depth of field.

6. In your professional judgment, which lighting source is most suitable to the performance of law enforcement duties and public safety?

LOW PRESSURE 7 HIGH PRESSURE 27

NO DIFFERENCE 12 NEITHER IS SUITABLE 11

7. Is the advantage of this lighting source:

DISTINCT 16		MODERATE 16		SLIGHT 8		NO ADVANTAGE 13	
HPS	13	HPS	9	HPS	4	HPS	1
LPS	2	LPS	3	LPS	1	LPS	1
OTHER	1	OTHER	4	OTHER	3	OTHER	11

8. Do you have any additional comments on the difference of high pressure, low pressure, or any other form of street lighting?

Less glare with HPS than mercury vapor. HPS lights street more. "LPS hazardous to officers and citizens." Both distort colors. City should install one kind only to add to consistency of descriptions. Neither as good as mercury vapor.

(SKIP TO QUESTION 11)

IF ONLY ONE KIND OF SODIUM STREET LIGHTING IS USED IN YOUR BEAT, PLEASE ANSWER QUESTIONS 9 AND 10 ONLY.

9. If only one kind of sodium street lighting is used in your beat, what kind is it?

LOW PRESSURE SODIUM 13 HIGH PRESSURE SODIUM 9

10. Has the ability to perform law enforcement duties been affected positively or negatively in any if the following respects by the above form of street lighting? Please explain reasons below.

LPS/HPS	AFFECTS POSITIVELY	AFFECTS NEGATIVELY	NO DIFFERENCE	DON'T KNOW
a. Distinguishing color	3/2	7/1	3/5	-/1
b. General visibility	4/2	4/3	5/4	-/-
c. On-road visibility	3/2	4/3	5/4	-/-
d. Off-road visibility	4/2	5/3	3/4	1/-
e. Property visibility	4/2	4/4	4/3	1/-
f. Visibility of persons	4/2	4/4	5/3	-/-
g. Crime prevention	2/1	4/3	4/4	2/-
h. Traffic conditions	3/2	3/3	5/4	2/-
	27 15	35 24	34 31	

REASONS: HPS/eyes don't adjust fast enough. Cause eye stress, fatigue. Business complaints re reduced lighting. Poor backlighting. LPS/harder to see. Not as bright. Color rendition extremely bad. Can't distinguish from amber traffic lights.

11. If you were to recommend installation of any kind of street lighting in your beat, what kind would it be?

LOW PRESSURE SODIUM 6

HIGH PRESSURE SODIUM 17

MERCURY VAPOR 22

NO PREFERENCE 6

EXISTING FORM ____

SOME OTHER ____

DON'T KNOW 6

THANK YOU

END