



Government of **Western Australia**  
Department of **Health**

# Investigation of Kidney Cancer Cases at Success Fire Station

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**Department of Health, WA**

**February 2015**

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## Executive Summary

The Department of Fire and Emergency Services (DFES) approached the Department of Health to investigate the occurrence of four cases of kidney cancer over a six year period (2009 to 2014) among firefighters based at the Success Fire Station.

At the same time DFES commissioned an independent environmental assessment of the Station and its surrounds (Golder Associates, 2015). The environmental testing of the site did not identify any hazards at levels that would indicate a potential causal agent for kidney cancer.

While the number of kidney cancer cases was higher than expected, the number of cases was low in relative terms and this, together with the small person-years of exposure, precluded a statistical analysis to assess whether an excess number of cases occurred among firefighters at the Station.

Regardless, an excess number of cases alone does not indicate existence of a causal agent, as cancer cases can occur in the same place by chance. Assessment of the characteristics of the cases against other criteria specified by the National Health and Medical Research Council (NHMRC) is needed to warrant a detailed investigation. The NHMRC criteria require the cancers be a rare type or sub-type of cancer, a causal agent exists, there is evidence of the duration and level of exposure to an identified causal agent that could reasonably be expected to give rise to the cancers, and the cases are in an age group not usually affected by the type of cancer.

The four kidney cancer cases are all of the same type, which accounts for 90 percent of all kidney cancer cases. Although all the potential exposure time for the cases ranged from 7.6 to 14.7 years, the lack of identification of a causal agent prevented determination of duration and levels of exposure to a potential hazard. While the ages at diagnosis for all cases were at the younger end of the expected range, these were not considered unusually young for a workforce cohort.

Considering together the characteristics of the four kidney cancer cases, it is unlikely that a cancer cluster exists at the Station. While a level of uncertainty remains around the finding that there is no cancer cluster at the Station due to the small number of cases investigated, the results of the environmental testing should reassure firefighters based at the Station.

### Recommendation

While the number of kidney cancer cases reported by firefighters at the Success Fire Station was too small to determine if their occurrence was due to chance, findings from the investigation of the characteristics of these cases were not consistent with the criteria of a cancer cluster. Further investigation into the kidney cancer cases is unlikely to uncover a single cause due to the small numbers involved.

# 1.0 Background

The Success Fire Station was opened in 2000 and built on vacant land with no land use history (Golder Associates, 2015). In October 2014, the firefighters at the Station were temporarily relocated pending the outcome of investigations into the four cases of kidney cancer reported among the firefighters from 2009 to 2014.

Staff first became concerned about potential hazards in the building after a third firefighter was diagnosed with kidney cancer in 2014, following two previous cases diagnosed in 2009 and 2010. A fourth firefighter was diagnosed with kidney cancer in 2014, increasing the fears of a cancer cluster among staff.

The Department of Fire and Emergency Services (DFES) raised the health concerns of the firefighters with the Department of Health, WA (DoHWA). DFES sought assistance to determine if there is an increased risk of contracting kidney cancer as a direct result of working at the Success Fire Station and, if so, to help identify a cause of the increased risk. Further investigations into the existence of contaminants at the Station (Golder Associates, 2015) and medical screening of firefighters for kidney cancer were commissioned by DFES.

In response to the concerns raised by DFES, the DoHWA has undertaken a preliminary study to assess the likelihood of a cancer cluster among the firefighters at the Station based on the initial evidence.

## 1.1 Kidney Cancer in WA

Kidney cancer was the one of the ten leading cancer types in 2012 among males with 205 new cases registered during 2012. The estimated lifetime risk of kidney cancer to age 75 in WA was 1 in 76 for males (Threlfall and Thompson, 2014).

There are many different types of cancer, each with known or suspected cancer causing agents associated with its development that may be common with other types or unique to the specific cancer. The development of cancers associated with exposure to cancer causing agents may take many years, even decades before diagnosis, which makes it difficult to identify the cause of any cancer.

According to the International Agency for Research on Cancer (IARC), the known causes of kidney cancer are tobacco smoking, trichloroethylene, X radiation, and gamma radiation (IARC, 2014, Cogliano et al 2011). There is also convincing evidence of an increased risk of kidney cancer due to body fatness (WCRF/AICR, 2007). Other risk factors which have been linked with kidney cancer include hypertension, long-term use of pain medication, specific genetic conditions, hepatitis C infection, long term dialysis and acquired cystic disease, family history, treatment for other cancers and occupational exposure to substances (asbestos, cadmium, dry-cleaning solvents, herbicides, benzene, organic solvents and petroleum products) (Cancer Council Australia, 2015; Cancer Australia, 2015; Cancer Research UK, 2015). The risk of kidney cancer is also higher in males compared to females (Threlfall and Thompson, 2014).

## 1.2 Cancer clusters

A disease cluster is the occurrence of a greater than expected number of cases of a particular disease within a group of people, a geographic area, or in a period of time. Cancer cases can occur by chance, so establishing the existence of an excess number of

cases on its own does not indicate a causal agent is present. The need for an investigation into a cancer cluster requires the presence of certain features to demonstrate its occurrence is due to other factors rather than chance.

The National Health and Medical Research Council specify the features that need to be present to warrant a detailed investigation (NHMRC, 2012).

Firstly, a large number of the same type of cancer (sub-type of breast cancer, for example) needs to be present in the study population. Investigating the number and distribution of cancer types in the study population provides evidence of occurrence of common or rare cancers.

Secondly, there must be an excess number of a specific cancer type in the study population when compared to the general population. The excess number of cancer cases takes into account the size, age and sex structure of the population and the period over which the cancer has appeared. The expected number of cases is determined by applying the age and sex-specific rates of a reference population (Perth male population in this study) to the age and sex-specific total exposure time in the study population. The period of time over which the cancers were observed must be matched by the period over which the rates of the reference population were calculated. However, in small study populations, the number of cases and total time of exposure may be too small for meaningful statistical analysis. The observed number of cases is divided by the expected number of cases to derive a Standardised Incidence Ratio (SIR). Demonstrating the SIR is statistically greater than one indicates an excess number of cancer cases in the study population.

Lastly, lifestyle, occupational and environmental exposures must be considered. Exposure of the study population to a known or suspected cancer causing agent must be demonstrated, along with evidence that the duration and level of exposure could reasonably be expected to give rise to the incidence and type of cancer observed.

Although an identifiable cause may or may not be found, the occurrence of a rare type of cancer in an age group that is not usually affected by the type of cancer is more likely to result in the confirmation of a cancer cluster.

## **2.0 Success Fire Station kidney cancer cases**

No information has been gathered about the occurrence of any other type of cancers other than kidney cancer among the firefighters. Four cases of kidney cancer have been identified among the male fire fighters at the Station over a six-year period from 2009 to 2014, with cases diagnosed in 2009, 2010 and 2014.

All four cases have been registered with the WA Cancer Registry and verified as clear cell adenocarcinoma cases.

The ages of the men at diagnosis ranged from 45 to 52 years, with an average age of 47.8 years.

For the purposes of this study, the exposure is defined as the time spent employed at Success Fire Station. Records of service for the four firefighters indicate that the potential time of exposure ranged from 7.6 to 14.7 years.

## 2.1 Exposure to potential hazards

An independent study to assess the potential environmental hazards of the station was undertaken by Golder Associates. The study targeted chemicals known to be associated with cancer, particularly kidney cancer. Environmental monitoring included sampling of indoor air, ground water, surface water, tap water, soil and swabs of internal and external surfaces. The study also looked for evidence of current or previous activities undertaken on site or nearby, including historical land use records, that could result in environmental contamination with chemicals of concern. The study found that there were no activities undertaken on site or in the surrounding environment that could result in environmental contamination with chemicals of concern. Results of environmental sampling found no levels of chemicals of concern exceeding health guidelines or where guidelines were not available, calculated levels of exposure would not result in untoward health effects. The study concluded that "...there is no identified link between the site and the incidents of kidney cancer".

Toxicologists from the Environmental Health Directorate of the DoHWA reviewed the Golder report. It was noted that investigations of the type conducted have limitations due to the inability to detect past exposures and do not assess occupational practices to detect all possible chemical exposures. Despite these limitations, the DoHWA considers that the environmental investigation undertaken by Golder looked at the appropriate chemicals of concern and undertook a detailed environmental investigation. The DoHWA agrees that there was no evidence of potential exposures in the environment at Success Fire Station that could have led to the development of kidney cancer among the firefighters.

Over and above where they are based, firefighters in the course of their duties are exposed to a range of cancer causing agents. Consequently associations between cancers and firefighting have been extensively studied. Exposures are typically intense for short periods of time, and range widely depending on the firefighters role, type of fire, time spent at fires and protective gear (IARC, 2010). A recent study in Australia found that overall cancer incidence for male career full-time firefighters compared to the Australian population was significantly raised for the group as a whole and for those who had worked for longer than 20 years (Monash Centre for Occupational and Environmental Health 2014).

There has been no specific systematic review of studies of kidney cancer among firefighters. While a systematic review conducted by IARC in 2010 of cancer associated with fire fighting in 2010 concluded firefighting is possibly carcinogenic to humans, kidney cancer was not found to be associated with firefighting.

Specific studies into associations between kidney cancer and firefighting vary due to difficulties with accurately assessing individual exposure and show mixed findings. There have been specific studies which have shown an increased kidney cancer incidence in firefighters (Delahunt et al, 1995; Ahn et al, 2012; Idle, 2014), while others were unable to show any increase (Bates, 2007; Pukala et al, 2014). The most recent study in Australia found that kidney cancer was significantly increased for firefighters who worked more than 20 years compared to those who worked for three months to 10 years, and there was a positive trend with employment duration, but this finding is based on only one case in the comparison group, so needs to be treated with caution. There was no trend with number of incidents attended (Monash Centre for Occupational and Environmental Health, 2014).

The Worker's Compensation and Injury Management Amendment Bill 2013 of the Western Australian Parliament provides for compensation to firefighters diagnosed with primary site

kidney cancer based on the length of service in recognition of the occupational risks of firefighting. (Parliament of Western Australia, 2015)

It must be also recognised that while the firefighters diagnosed with kidney cancer spent part of their day at the Station, most of their time was spent in other environments during the period they worked at the Station. In addition, the firefighters have spent only a short time of their lives working at the Station. The exposure to other environmental, lifestyle and even genetic risk factors outside of the workplace all need to be considered, but with a small number of cases it is unlikely this would assist in identifying a single cause.

## **2.2 Workforce size and structure**

Since opening in 2000, a total of 309 firefighters have worked at Success Station for various lengths of time, the majority were male, with only 17 females (5.5%). Between 16 and 29 firefighters worked at the Station per year, working in shifts. As at October 2014, 26 firefighters were based at the Station, all were male.

The male population of the Perth metropolitan area was chosen as the reference population for the study, as this population was the closest that matched the workforce with a known age-specific kidney cancer incidence. The low number of person-years of exposure (a median of 18 years per year, and 315 in total), combined with the relatively low incidence of kidney cancer in the reference population makes it difficult to estimate the expected number of kidney cancers in the workforce with any statistical certainty. In fact, the expected number of cases was less than one.

In this case, the ratio of the expected number of kidney cancer cases (<1) to those diagnosed is also complicated by the low number of kidney cancers diagnosed among the workforce (4) from 2000 to 2014.

Effectively, while a crude analysis shows the number of cases was higher than might be expected, assessment of the existence of a cancer cluster using the Standardised Incidence Ratio is meaningless as the small size of the workforce and the low number of cancers diagnosed among the workforce precludes the use of statistics.

## **3.0 Kidney Cancer among Cockburn residents**

Expanding the study to the population of the Cockburn Statistical Local Area allows an assessment of the existence of excess cancer cases in the Cockburn population. While the findings of this study will not be directly applicable to the workforce at the Station, it will assist in determining if excess kidney cancer cases exist in the surrounding area of the Station, potentially pointing to other possible causes.

Kidney cancer incidence in Cockburn over the five-year period from 2008 to 2012 was investigated, using the most recent data available from the WA Cancer Registry. Although there were many more kidney cancer cases among males than females in the Cockburn population in the five-year period, the Standardised Incidence Ratios were close to one for both genders, indicating the incidence of kidney cancer was similar to the State incidence for males and females (Table 1).

**Table 1: Number of kidney cancer cases and Standardised Incidence Ratios (SIR) for residents of Cockburn, 2008 to 2012.**

Gender	N	SIR	95% CI
Males	46	1.40	1.00-1.83
Females	13	0.77	0.37-1.24

Note: SIR is the ratio of observed cases to expected cases. A SIR which is statistically significantly greater than one indicates that the cancer incidence in a cohort is higher than the rate of the comparison population (State). Statistical significance is indicated by the 95% confidence interval (95% CI) being greater than one.

## 4.0 Discussion

Typically, cancer clusters are identified by a single cancer type occurring in large numbers in a cohort. Four kidney cancer cases of the same type were diagnosed among the firefighters based at the Success Fire Station in a six year period. The type of kidney cancer is common and accounts for 90 percent of all kidney cancers, indicating that the cancers are not rare types. However, it is unusual that only kidney cancers have been reported among the firefighters and it is unknown if other types of cancer cases were diagnosed among the same cohort during the same time. It may be that the demographics characteristics, lifestyle behaviours and occupational practices might prevent the more common types of cancers (lung, prostate, colorectal and melanoma) among this cohort.

Statistically, the number of cases and the person years of exposure were too small to assess if there was an excess number of cases diagnosed among firefighters, in the period, compared to the Perth Metropolitan male population. Even if an excess number of cases were found, this alone is not evidence of a cancer cluster as the characteristics of the cases need to meet certain criteria to establish the cases were not due to chance.

While the ages at diagnoses of the four cases were at the younger end of the expected age range for kidney cancer, based on State information presented by the WA Cancer Registry, around 16 percent of cases are diagnosed at these ages (45 to 54 years) throughout the State (Threlfall and Thomson, 2014). Also, the average age at diagnosis would be expected to be younger among firefighters compared to the general population as the cohort is entirely of working age.

With the lack of identification of any potential carcinogenic agents from environmental testing at the Station (Golder Associates, 2015), it is impossible to demonstrate a causal pathway for the development of kidney cancer involving the environment around and in the Station, even though the four cases had potential exposure times ranging from 7.2 to 14.7 years. Without an identified carcinogen and the levels of exposure, the duration of exposure alone is meaningless. This suggests the cancers were the result of influences other than around and within the Station.

As the kidney cancer incidence in the Cockburn Local Government Area for males and females was similar to the State incidence for both genders, it is unlikely that there is a large scale environmental factor influencing the kidney cancer incidence at the Station.

Considering together the details of the four kidney cancer cases and the lack of a possible environmental cause, it is unlikely that a cancer cluster exists at the Station.

Firefighting is a dangerous occupation with risks to health as highlighted by the cancer risks reported by IARC. While a level of uncertainty remains around the finding that there

is no cancer cluster at the Station due to the small number of cases investigated, the results of the environmental testing should reassure firefighters based at the Station.

## 5.0 Recommendation

While the number of kidney cancer cases reported by firefighters at the Success Fire Station was too small to determine if their occurrence was due to chance, findings from the investigation of the characteristics of these cases were not consistent with the criteria of a cancer cluster. Further investigation into the kidney cancer cases is unlikely to uncover a single cause due to the small numbers involved.

## 6.0 References

Ahn Y-S, Jeong K-S, Kim K-S. (2012). Cancer morbidity of professional emergency responders in Korea. *Am J Ind Med*;55(9):768-78.

Bates MN (2007). Registry-based case-control study of cancer in California firefighters. *Am J Ind Med*. May;50(5):339-44. PubMed PMID: 17427202. Epub 2007/04/12. eng.

Cancer Council Australia. Kidney cancer: Causes. <http://www.cancer.org.au/about-cancer/types-of-cancer/kidney-cancer.html> [accessed 2015]

Cancer Australia: Kidney Cancer: What are the risk factors for kidney cancer. <http://canceraustralia.gov.au/affected-cancer/cancer-types/kidney-cancer> [accessed 2015].

Cancer Research UK. About Cancer: Risks and causes of kidney cancer. <http://www.cancerresearchuk.org/about-cancer/type/kidney-cancer/about/risks-and-causes-of-kidney-cancer> [accessed 2015].

Cogliano VJ, Baan R, Straif K, Grosse Y, Lauby-Secretan B, El Ghissassi F, et al. Preventable exposures associated with human cancers. *Journal of the National Cancer Institute*. 2011 Dec 21;103(24):1827-39.

Delahunt B, Bethwaite PB, Nacey JN (1995). Occupational risk for renal cell carcinoma. A case-control study based on the New Zealand Cancer Registry. *British Journal of Urology*.;75(5):578-82.

Golder Associates (2015). Workplace Contaminant Investigation – Success Career Fire and Rescue Station.

Ide C (2014). Cancer incidence and mortality in serving wholetime Scottish firefighters 1984–. *Occup Med (Lond)*. 64:421-7.

International Agency for Research on Cancer (2010). IARC Monographs: The known causes of human cancer by organ site (updated 12.2014) available from: <http://monographs.iarc.fr/ENG/Publications/OrganSitePoster.pdf>

International Agency for Research on Cancer (2010). IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 98: Painting, Fire-Fighting and Shiftwork. Lyon, France: International Agency for Research on Cancer. .

Monash Centre for Occupational and Environmental Health (2014). Final Report Australian Firefighters Study. Monash University.

National Health and Medical Research Council (2012). Statement on Cancer Clusters. [http://www.nhmrc.gov.au/\\_files\\_nhmrc/publications/attachments/ps0006\\_statement\\_cancer\\_clusters.pdf](http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/ps0006_statement_cancer_clusters.pdf).

Parliament of Western Australia (2015) Worker's Compensation and Injury Management Amendment Bill 2013.

<http://www.parliament.wa.gov.au/parliament/bills.nsf/BillProgressPopup?openForm&ParentUNID=51F2C6F0CD3AE20A48257BC000373F98>. [accessed 2015]

Pukkala E, Martinsen J, Weiderpass W, Kjaerheim K, Lynge E, Tryggvadottir L, et al (2014). Cancer incidence among firefighters: 45 years of follow-up in five Nordic countries. *Occup Environ Med.* 71:398-404.

Threlfall TJ, Thompson JR (2014). *Cancer incidence and mortality in Western Australia, 2012*. Department of Health, Western Australia, Perth. Statistical Series Number 97. [http://www.health.wa.gov.au/docreg/Reports/Diseases/Cancer/WACR\\_Cancer\\_incidence\\_mortality\\_main\\_2012.pdf](http://www.health.wa.gov.au/docreg/Reports/Diseases/Cancer/WACR_Cancer_incidence_mortality_main_2012.pdf).

World Cancer Research Fund / American Institute for Cancer Research. Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective - See more at: [http://www.dietandcancerreport.org/expert\\_report/index.php#sthash.e6dwqztv.dpuf](http://www.dietandcancerreport.org/expert_report/index.php#sthash.e6dwqztv.dpuf). 2007.



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